PHLS

Annual Report 1985/86

The Public Health Laboratory Service

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1985/86

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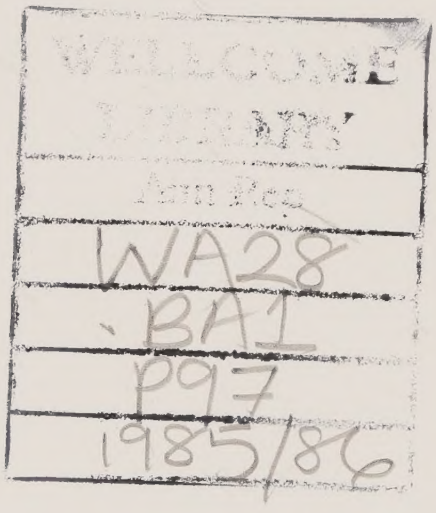

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Introduction

For the Public Health Laboratory Service the year 1985/86 had considerable significance. Her Majesty the Queen conferred honour upon, and gave much pleasure to, the Service and the PHLS Board by graciously opening the new Central Public Health Laboratory (CPHL) at Colindale on 11 December 1985. On the same day the Princess of Wales visited the PHLS Laboratory, Ashford to see the work done in support of the national rubella vaccination programme.

These signal marks of recognition followed close upon the decision of Ministers, conveyed to the PHLS Board in October 1985, to reject the ill-judged recommendation of the DHSS Review of the PHLS to transfer the administration and funding of PHLS area and regional laboratories to the Health Districts in which they are located. This proposal triggered a vigorous countrywide response, pointing out the folly of destroying a national resource essential to the control of infection and communicable disease. The support for the work of the PHLS was deeply appreciated by all staff, and I should like to thank everyone who played a part in helping to demonstrate to Ministers that the PHLS is a vital and effective national asset.

The year also saw the retirement of the fourth Director of the Service, Dr JEM Whitehead. Appointed as Director in July 1981, Michael Whitehead succeeded Sir Robert Williams at a time of increasing pressure upon the Service. This was due especially to financial squeezes, but also to such matters as the assimilation into the Service of the Centre for Applied Microbiology and Research (CAMR), Porton Down, the final stages of completing the new £24 million Colindale Laboratories, and the DHSS Review of the PHLS. His period as Director also saw the beginning of the AIDS epidemic in the UK, the major food poisoning outbreak at the Stanley Royd Hospital, Wakefield, and the Stafford Legionnaires' disease outbreak, which severely stretched a PHLS grappling with the financial restrictions of the 1980s. Dr Whitehead's long experience in the PHLS included a period of six years as Deputy Director of the Service and sixteen years in charge of the PHLS laboratory at Coventry. This wealth of experience, together with his commitment during four years as Director, proved of great value in enabling the Service, despite the pressures, to continue its work on infections and communicable diseases throughout the country. He retired on 11 September 1985, with the warm appreciation and affection of all the Service. I was appointed to succeed

Dr Whitehead, and formally assumed my new responsibilities on 12 September 1985.

Dr PD Meers, a Deputy Director of the PHLS since 1981, left the Service in March 1986 to take up a microbiological post in Singapore. Peter Meers had served as Director of the PHLS Plymouth laboratory from 1969 to 1978, and of the Division of Hospital Infection at CPHL from 1978 to 1981, before moving to Headquarters where he was able to contribute greatly to the work of the whole Service.

The demands upon PHLS expertise and services will grow. It is of course true that, due to both medical and social advances, many infectious diseases are now well controlled in the UK. Infections such as typhoid, cholera, diphtheria, tetanus and poliomyelitis, for example, are now rarely seen, and many other infections respond to treatment with antimicrobial durgs. But, just as in the past when infections such as syphilis or plague emerged to spread around the world, 'new' micro-organisms are liable to appear as pathogens in response to changes in human behaviour or the environment, as AIDS and legionellosis have shown. Advances in medical treatment also bring new infectious challenges, for example in intensive care, the nursing of premature babies, or the use of immunosuppression in the therapy of cancers and in transplant surgery. Patients treated by these means become highly susceptible to the attack of microbes, including organisms such as those of the normal flora which rarely affect healthy people. Demands upon laboratory services also grow as research reveals the microbial causes of diseases previously of unknown aetiology. Many such discoveries have been made recently—fifth disease, Lyme disease, a number of cancer viruses and intestinal pathogens such as *Campylobacter* species and Norwalk virus, for example. The safe and effective use of new therapeutic agents, including anti-viral drugs, often depends upon laboratory support for precise diagnosis, determination of sensitivities and monitoring blood levels. Medical microbiologists are also increasingly involved in advising at the bedside upon the diagnosis and treatment of infection, and upon the prevention and control of infection acquired or spread within hospitals. At the same time, PHLS microbiologists are more and more called upon in their duties to public health—to support community physicians, Environmental Health Departments and others in diagnosis, investigation and control of sources of infection in the community at large. In many parts of the country the capacity of the community health services to deal with infection and communicable disease has become weakened, and depends far more heavily than in the past upon PHLS area and regional laboratories, backed up by PHLS reference laboratories and the Communicable Disease Surveillance Centre (CDSC).

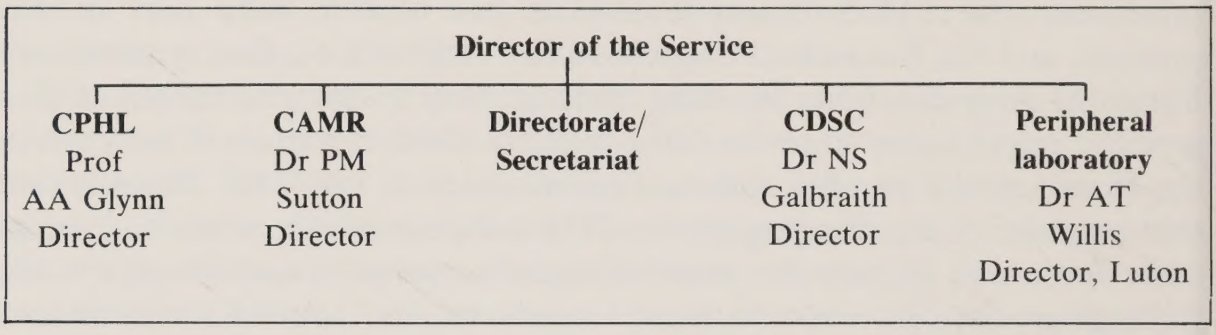
Against this changing and extremely interesting professional scene, the PHLS is developing managerially in parallel with the rest of the National Health Service in response to the Griffiths recommendations and the associated Korner requirements for greater information upon which to base management decisions. All branches of medicine, and indeed all

countries, are nowadays having to come to terms with the dilemma of apparently unlimited demand for health services alongside inevitably limited funds to pay for them.

An important feature of the development of management in the NHS is the Accountability process, whereby NHS Regional Chairmen meet annually with Ministers to account for their work in relation to Ministers' priorities. The PHLS Board Chairman has now to take part in this process, and the Board had to prepare in 1985/86 for a first, preliminary Financial Accountability meeting, held in May 1986. The meetings also give the opportunity to invite Ministers to consider matters of concern to the Board, and a number assumed prominence in 1985/86. There is first the question of the funding of the PHLS. Because of a worsening in its cash limit, and despite the most stringent economies and savings made throughout the Service, the Board needs to find some £2 million per annum to resolve its current shortfall. The growth of hospital diagnostic work in PHLS laboratories, which provide the microbiology for the hospitals at which they are located, has drawn in funds at the expense of PHLS national and community public health work; and urgent re-examination is necessary of the basis upon which the costs of PHLS area and regional laboratories are shared between District Health Authorities and the PHLS Board. Second, the number and distribution of PHLS laboratories in England and Wales has to be reviewed by the Board to ensure relevance to the infections and communicable diseases, and the financial and other resources, of the 1980s and beyond. In accordance with Ministers' wishes the Board has begun such a review. A third question is the role of CAMR and the means by which it should be managed. This must be re-appraised in the light of the marketing and distributorship agreement made with Porton Products Ltd in 1985, and of Ministers' expectations that income from the sale of CAMR products and processes would be maximised.

There are also two aspects of PHLS work that particularly need to be strengthened. The first of these is epidemiology in relation to infection and communicable disease, not only at CDSC but throughout the Service. Community medicine nowadays depends much more upon the PHLS than in the past. The PHLS needs to ensure that adequate expertise and resources are available to support the investigation and control of outbreaks whenever they occur, the surveillance of vaccination programmes, the study of 'new' microbial diseases and other work in the infection field relevant to public health. The developing AIDS epidemic, in particular, has highlighted these needs, and has also thrown into prominence the difficulties that funding restrictions have imposed upon the peripheral laboratories. The second area of PHLS work that needs strengthening is related to the first, and concerns information and computing. For epidemiological purposes, and to enable the Service collaboratively to respond as effectively as possible to outbreaks and other demands, the PHLS Board wishes to improve information collection, interchange and analysis, and the co-ordination of activities throughout the Service.

Clearly, these are challenging times for the PHLS, and to help optimise the response of the Service, a new Management Team has been established, which held its first meeting in January 1986. It is constituted as in the diagram below, and will be concerned particularly with strategies for meeting PHLS objectives.



Dr JWG Smith

Statement by the Chairman of the PHLS Board

The PHLS, through its network of peripheral laboratories, its reference laboratories and the Communicable Disease Surveillance Centre (CDSC), is the Government's main resource for the control of infections and communicable diseases. Such is its success that many other countries have used it as a model for the development of similar laboratory services. Nevertheless, for the first half of the year 1985/86, the inappropriate recommendation of the DHSS Review of the PHLS—that its network of peripheral laboratories should be transferred to NHS Districts—remained unresolved. After wide consultations, however, the DHSS informed the Board in October 1985 that Ministers had rejected this recommendation. The Board warmly appreciates the support given to the PHLS and its work during this period of consultation. This support, together with the Board's own response, enabled Ministers to recognise clearly the damage to public health that would have resulted if the recommendation had been acted upon. However, the Review left unanswered the question of whether the present structure of the PHLS laboratory network is appropriate and effective for today's circumstances. Ministers rightly expect the Board to examine this question along with the basis upon which the costs of the peripheral laboratories are shared between the PHLS Board and health authorities. Steady growth of the diagnostic services provided by PHLS laboratories to NHS District hospitals has been at the expense of PHLS resources intended for national and community health work concerned with the identification, investigation and control of infections and communicable diseases. The need to put these financial arrangements upon a more satisfactory footing is now an urgent matter, not least because the PHLS has an estimated annual deficit of some £2 million. The Board has responded to funding pressures by rigorous economies, and the Service is currently living within its means only by the expedient of severely limiting capital expenditure on equipment and buildings, a state of affairs which clearly cannot continue without permanently damaging the work of the Service.

Her Majesty the Queen graciously opened the new Central Public Health Laboratory (CPHL) at Colindale on 11 December 1985, and it gave me and the Board great pleasure to see the interest she showed in the work demonstrated by the staff. The commemorative inscription unveiled by the Queen is now mounted in the reception hall of the new CPHL as a permanent record of a day of which the PHLS is very proud. On the same day Her Royal Highness the Princess of Wales visited the Ashford PHLS laboratory where Dr Dulake had the honour of demonstrating its work in relation to the rubella vaccination programme in which the Princess has a particular interest as President of the Rubella Council.

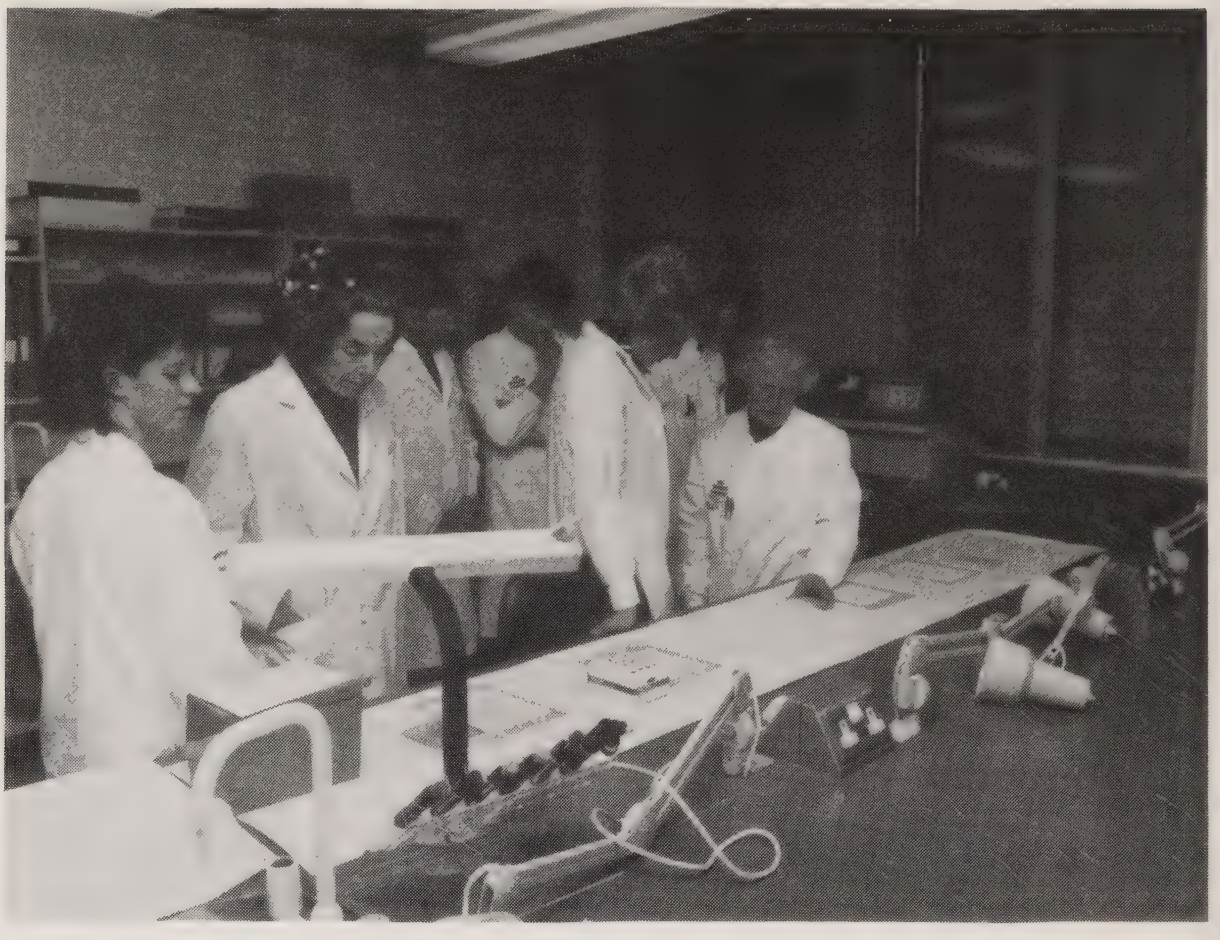


Figure 1 The Royal Party at Ashford

Dr JEM Whitehead retired as Director of the Service on 11 September 1985. He had served in this post with great credit since 1981, in a particularly difficult period of financial stringencies and of uncertainties associated with the two years of the DHSS Review of the Service. His tireless work was greatly appreciated by all members of the Board, and he won the warm affection of all members of the Service. His place has been taken by Dr JWG Smith, previously a Deputy Director of the PHLS Epidemiological Research Laboratory and Director of the National Institute for Biological Standards and Control for the past nine years. His background in microbiology and epidemiology and his experience at NIBSC will be of great value to him in his new post, to which I warmly welcome him.

Dr Smith has joined us at a demanding time. I have already mentioned the need to review the laboratory network, and have touched upon our financial problems. At the same time, there are new challenges in the professional work of the PHLS, such as legionellosis and AIDS. There is also the need to develop further the commercial potential of the Centre for Applied Microbiology and Research (CAMR) in association with Porton Products Ltd. I referred in last year's Annual Report to the agreement made with Porton Products, signed in March 1985, by which the company is given the opportunity to market products and processes developed by CAMR. These important matters, and others referred to in the Director's report, are placing onerous demands upon the Service and

particularly upon its senior officers. To support the Director in this work, the Board has approved the formation of his new Management Team, composed of the Directors of CPHL, CAMR, CDSC and the Director of a peripheral laboratory (currently Dr Trevor Willis), together with senior headquarters staff. This team is now meeting regularly and is already proving its worth in strategic planning.

There is just one other major new development I should touch upon—the Accountability Review process whereby I, like the Chairman of NHS Regions, am required to meet annually with Ministers to review progress and agree objectives. The Board was advised in 1985/86 that it was expected to embark upon the first of these reviews in 1986/87. This is a welcome opportunity to demonstrate to Ministers the value of the Service, to present its needs and requirements, and to learn where changes in the work of the Service may be appropriate in order to meet new Government requirements.

There were a number of changes in the composition of the Board in 1985/86. I am very grateful to Mr RG Hoare, Dr WCD Lovett and Dr M Sackwood for their contributions; also to Professor MH Richmond who, it is a pleasure to record, became Sir Mark Richmond in the 1986 Queen's Birthday Honours. I extend a warm welcome to Dr PW Russell Eggitt and Dr Deirdre J Hine, who joined the Board during the year.

CE Gordon Smith

Public Health Laboratory Service Board

This is the Board membership on 21 October 1986

Chairman

CE Gordon Smith, CB, MD, DSc, FRCP, FRCPath
Dean, London School of Hygiene and Tropical Medicine

Deputy-Chairman

CC Stevens, CBE, LLB, FPS
lately Chairman, Cheshire Area Health Authority

Members

Professor AR Buchan, MD, FFCM, DPH
Medical Officer, Leicestershire Health Authority

D Cormack, ATI, PhD
Management Consultant

AE Eames, DMA, FIEH, FICS, MRSH
Chief Environmental Health Officer, North Wiltshire District Council

PW Russell Eggitt, OBE, BSc, PhD, FRSC, FIFST, FRSH
Director of Research and Technology, Dalgety (UK) Ltd

JM Forsythe, MSc, FRCP, FFCM, DObstRCOG

AP Haines, MB, BS, MRCP, MRCGP
Senior Lecturer in General Practice, St Mary's Hospital Medical School

EL Harris, CB, MB, BCh, FRCP, FRCPE, FFCM
Deputy Chief Medical Officer, Department of Health and Social Security

P Higham, FCA
Financial Consultant

Deirdre J Hine, MB, BCH, FFCM, DPH
Deputy Chief Medical Officer, Welsh Office

Professor Rosalinde Hurley, MD, FRCPath, LLB
Barrister at Law and Professor of Microbiology, University of London

MJ Painter, MSc, MB, BS, MFCM
Medical Officer for Environmental Health, Manchester

AJ Rowland, MB, ChB, FFCM. DPH, DObstRCOG
Specialist in Community Medicine, Cornwall and Isles of Scilly Health Authority

Professor Harry Smith, PhD, DSc, FRCPath, FIBiol, HonMRCP, FRS
Professor of Microbiology, University of Birmingham

Professor AJ Zuckerman, DSc, MSc, MD, FRCP, MRCS, LRCP, FRCPath, DObstRCOG, DipBact
Professor of Microbiology, University of London

Staff Assessors to the Board

B Gee, BA, FIMLS

MJ Hill, PhD, MRCPath, ARIC

DM Jones, MD, FRCPath, DipBact

Secretary to the Board

RB Paget, MA, MBA, FIPM, FBIM

Members of the Board to 31 July 1986

AD Bostock, MB, ChB, DPH, FFCM

Professor FW O'Grady, CBE, TD, MSc, MD, FRCP, FRCPath

PHLS functions, objectives and activities

The major objective of the Public Health Laboratory Service is to provide the most effective and efficient service possible to support the diagnosis, prevention and control of infections and communicable diseases in England and Wales. This objective is carried out by the detection of infection and infectious agents, epidemiological analysis, investigation of outbreaks, development of strategies for prevention and control, the provision of advice and relevant research. A second main objective is that of income generation, which mainly concerns the Centre for Applied Microbiology and Research (CAMR), and is met by research and development directed to the sale of services and the development of commercial therapeutic, diagnostic and other products.

Legislative background

In 1945 the Government decided to put the wartime Emergency Public Health Laboratory Service on a permanent footing as the Public Health Laboratory Service. The Medical Research Council (MRC) agreed to continue administering it on behalf of the Ministry of Health. Section 17 of the NHS Act 1946 authorised the Minister to provide a bacteriological service for the control of infectious diseases.

The PHLS Act 1960 transferred responsibility for the Service from the MRC to a new PHLS Board, established as a statutory body capable of acting in its own right as an agent for the Minister of Health. The Act also transferred the staff from MRC employment to the Board, and transferred property from the MRC to the Ministry.

The NHS Act 1977 (Schedule 3) incorporated the PHLS Board. Part I defined the formal constitution of the Board and Part II dealt with staffing and financial provisions. The PHLS Act 1979 extended the Board's powers by allowing it to carry out 'such other activities as in the Secretary of State's opinion can be conveniently carried out in conjunction with the Service'. This legislation enabled the Board to assume responsibility for the administration as a civil establishment of the former Microbiological Research Establishment of the Ministry of Defence at Porton Down, which the Board renamed the PHLS Centre for Applied Microbiology and Research.

The PHLS is administered by a statutory Board closely analogous to a Special Health Authority, but financed from the central funds of the DHSS. It is an essential part of the NHS, and its responsibility extends over the whole of England and Wales. PHLS staff are employed on NHS terms and conditions of service.

Organisation

The PHLS comprises 52 regional and area laboratories distributed throughout England and Wales (Figure 2), and 24 reference and special

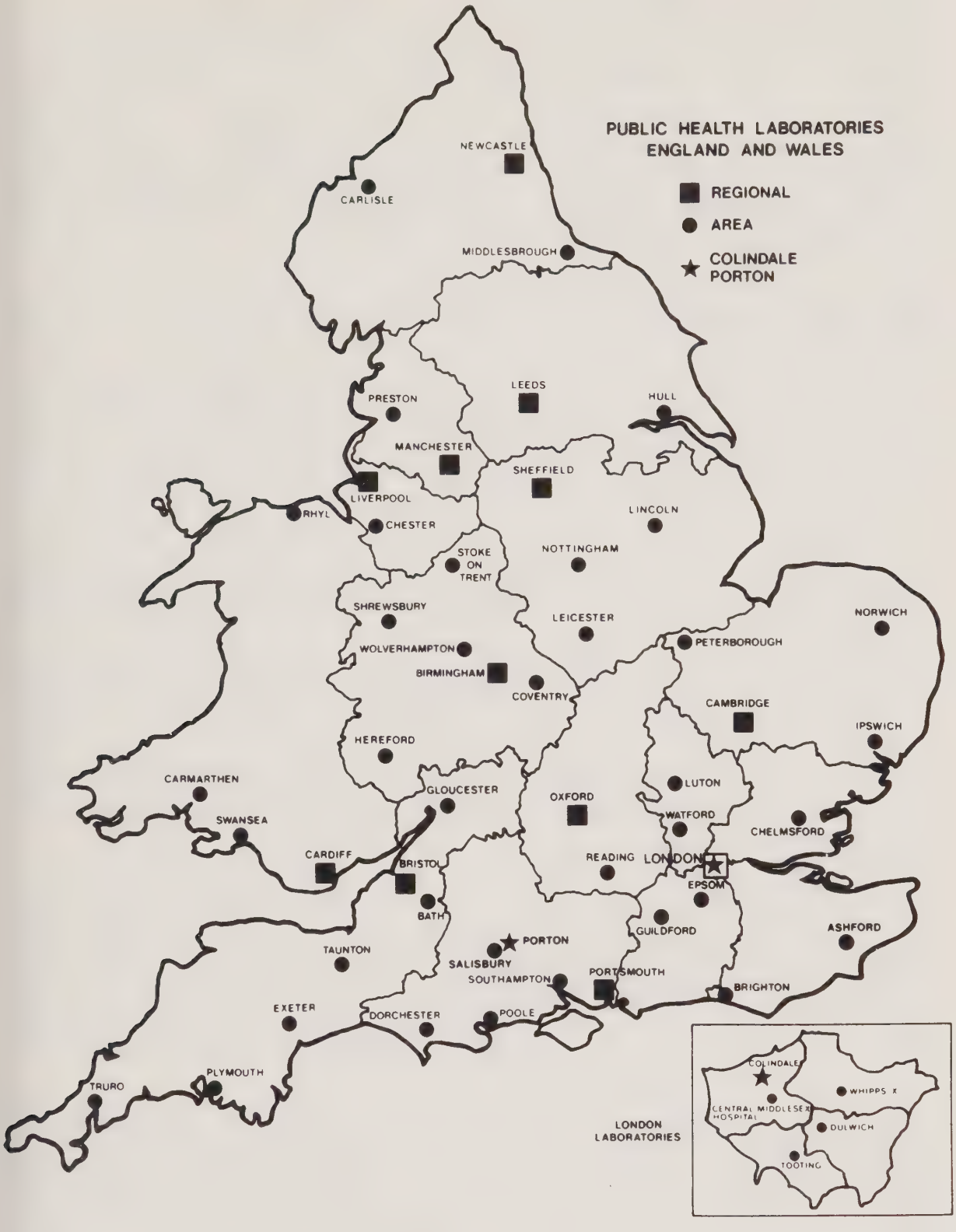


Figure 2 Where the PHLS laboratories are

laboratories or units, most of which are grouped in the Central Public Health Laboratory (CPHL) in Colindale, or at CAMR, Porton Down. The Service is administered from the Board's Headquarters at Colindale, where the PHLS Communicable Disease Surveillance Centre (CDSC) is also situated. Costs of the regional and area laboratories, which in addition to their PHLS work provide microbiological services for their local hospitals, are shared with the corresponding health authorities.

General scope of the service

The PHLS operates a network of centrally co-ordinated laboratories in accordance with its statutory obligations, primarily to provide a microbiological and epidemiological service for the diagnosis, control and prevention of infections and communicable diseases. The PHLS is also concerned, especially by means of the research and development work of CAMR, to develop applications of biotechnology—mainly, but not exclusively, in the health field.

Role of PHLS laboratories The functions of a PHLS area or regional laboratory are to provide:

- Microbiological and epidemiological support for Medical Officers of Environmental Health (MOsEH), Environmental Health Officers (EHOs), DHSS and others, and for clinical staff in hospitals or in the community, within the PHLS catchment area of the laboratory.
- Full collaboration with PHLS Headquarters and central reference and epidemiological facilities in the reporting and investigation of infections, control of outbreaks, assessment of vaccines, development of laboratory methods, etc.
- Public health microbiology as required in its catchment area (eg testing of food, milk, water, sanitary, environmental and outbreak specimens).
- Access to virology diagnosis and advice.
- The microbiological service, including Control of Infection Officer functions, to the District hospital with which it is associated, and to general practitioners.

Although a number of these activities are carried out in NHS microbiology laboratories concerned primarily with the service to their district hospitals, the five functions together serve to define the ways which distinguish PHLS laboratories. These can be summarised as a commitment to public health and the control and prevention of infection and communicable disease in the population as a whole.

Epidemiology and control of infection Through its CDSC, the PHLS collates information on the prevalence of infection, and when necessary institutes special investigations into the epidemiology of particular infectious diseases. A major feature of the PHLS is its effectiveness in the face of outbreaks of infectious disease. The concerted efforts of microbiologists in peripheral and reference laboratories, together with the added epidemiological expertise of CDSC, can and does act to prevent, investigate and control outbreaks of infection in the community and in hospitals. The regular reports of laboratory-proven infections received at CDSC from PHLS and hospital laboratories, supplemented by other data, form a continuously changing up-to-date picture of communicable disease throughout the country. This is analysed and published weekly in the *Communicable Disease Report*, which is issued to microbiologists, community physicians and others concerned with disease control. In

addition, through its CDSC, the PHLS co-ordinates the investigation and control of incidents of communicable disease of national importance and of outbreaks involving many local authorities.

Diagnostic microbiology The regional and area PHLS laboratories are in, or closely associated with, District hospitals, and provide their clinical microbiological and infection control services. They also serve GPs MOsEH, other doctors caring for communities and EHOs. The laboratories report to CDSC infections diagnosed from all these sources. By means of this continuous sampling at 52 different points throughout England and Wales, the PHLS monitors the infections which bring patients to hospital or which attack them while they are there. The PHLS also becomes aware of the distribution of communicable disease and its causative microbes in the community. All PHLS laboratories assist local hospital laboratories in the investigation of outbreaks of infections, if requested.

Surveillance of food and drink All regional and area laboratories provide a microbiological service to the Environmental Health Departments of local authorities by examining water, milk and, increasingly, other food stuffs and environmental samples such as water from cooling towers. Imported foods are sampled at the port of entry or centre of distribution. Raw foods, particularly meat and poultry, and animal feeds known to spread agents of food poisoning, are monitored to trace the origin and transmission of these organisms. The survival or multiplication of food poisoning bacteria in foods is studied and, depending on the results, preventive measures are initiated. At CPHL both the Food Hygiene Laboratory and the Division of Enteric Pathogens contribute substantially to this work. In the course of investigating outbreaks, laboratories are often required to examine foodstuffs and are always ready to advise manufacturers and distributors; but routine testing for commercial organisations is not ordinarily undertaken.

Surveillance of vaccination and immunisation Evaluation of the effectiveness and safety of many of the immunisation programmes in current use falls to the PHLS Division of Epidemiology (of which the CDSC forms the main part), which also investigates new immunisation procedures. (Those relating to Hepatitis B are the separate responsibility of the Hepatitis Epidemiology Unit.)

Provision of reference and special facilities Many PHLS laboratories carry out some of the more specialised tests needed for diagnostic microbiology by neighbouring PHLS and NHS laboratories, and a number also provide a national reference service. The major back-up facilities are provided by the reference laboratories or units which carry out various tests for the PHLS and for hospital laboratories throughout the UK. These tests usually require special expertise, techniques and facilities

which it would be uneconomic or impossible to provide more widely. As well as carrying out special tests—such as the fingerprinting of microbes for epidemiological purposes—reference laboratories conduct research in their particular fields. This enhances the quality of the advice they are able to offer.

In the laboratories of CPHL and CAMR, the PHLS develops and produces certain therapeutic, prophylactic and diagnostic materials for use by the NHS and others, as well as itself. The PHLS also monitors some commercially available reagents and provides a range of test materials to its own and hospital laboratories to enable them to assess the quality of their diagnostic performance. The National Collection of Type Cultures (of bacteria of medical interest) has long been a constituent part of CPHL; more recently, the European Collection of Animal Cell Cultures has been established at CAMR.

Research and development PHLS laboratories engage in research, and several—especially the reference and special laboratories—have extensive research programmes. An element of research must feature in the work of all diagnostic laboratories if they are to develop cost-effective improvements in methods or introduce tests for newly-discovered pathogens, such as the AIDS virus. The successful investigation of outbreaks also frequently depends upon a research approach. PHLS laboratories frequently join in collaborative investigations, for example to evaluate new tests or to study the epidemiology of an infection. CAMR in particular has a substantial programme of research and development in the sciences underlying biotechnology processes and their application.

The projects at CAMR are broadly of three kinds—in-house research, where the costs are a charge to PHLS funds; grant-supported research, where individual scientists have been awarded grants by bodies sponsoring research; and commissioned projects which are the subject of a contract with a commercial firm or other organisation. Commissioned research generates income (to the Exchequer) as may, ultimately, some of the in-house projects—a process which the Distributorship and Marketing Agreement concluded in 1985 with Porton Products Ltd should facilitate.

The Service can, at short notice, call on the very wide range of knowledge and ability of its nationally distributed specialist staff. Working parties with appropriate skills can be formed to tackle new problems as they arise, so achieving the highest probability of producing speedy and useful results.

Acceptance of specimens

The materials examined in PHLS laboratories comprise clinical specimens (throat swabs, blood, faeces, etc) from people suspected of suffering from microbial disease, or of being carriers of pathogenic microbes; and non-clinical (sanitary and environmental) specimens, such as food and water, submitted either as part of an epidemiological inves-

tigation or for public health surveillance. Acceptance of a specimen for examination is at the discretion of the laboratory Director. Normally there is no charge for examination. Clinical specimens are dealt with if submitted by medical practitioners, veterinarians, dentists or those acting directly on their behalf. Sanitary specimens can be submitted by MOsEH and EHOs (or members of their staff) acting on behalf of local authorities, or by others subject to the agreement of the laboratory Director.

The services of the reference and special laboratories are available to all PHLS, NHS and other official laboratories in the United Kingdom.

The advisory role of the PHLS

The PHLS is often asked to advise central and local government and the hospital service on many aspects of infections and communicable diseases. Consultation is frequently initiated by the PHLS, whenever local observation or central analysis reveals an infection problem that may require active study or intervention. The PHLS maintains close contact with veterinary organisations in areas of mutual interest, and collaborates with the World Health Organisation and with national laboratory and epidemiological services overseas. Particularly at CAMR, there is collaboration with commercial organisations on ways of applying microbiological expertise to industrial problems.

Prevention of infections and communicable diseases

The various activities referred to above combine to form a strong national resource for the prevention of infections and their spread. The PHLS response to outbreaks allows the earliest implementation of intervention and control measures. Equally, the diagnostic surveillance activities, research and development, reference work and advisory work are all directed, not only to the diagnosis and treatment of infection but, more significantly in terms of national health, to disease prevention.

The work of the Service

The number and range of specimens examined by PHLS regional and area laboratories provides some indication of their activities (Table 1). Approximately 7.4 million specimens were examined, of which some 25 per cent related to the diagnosis of virus infections. The total represents an increase of 4 per cent over that in 1984/85. As mentioned in last year's Report, the rate of increase in the numbers of specimens examined has slowed, but nevertheless numbers continue to rise, for a number of reasons. The growing reliance of diagnostic and therapeutic medicine upon laboratory tests continues, as does the growth in the range of tests available to support the clinician. Advances in virology are a specific example of the latter: diagnostic tests are being introduced for an increasing range of pathogens, and the most prominent recent example is for diagnosis of infection with the AIDS virus. Superimposed upon these developments is the improving efficiency of NHS hospitals in respect of bed usage and attendance at out-patients, which inevitably creates increased demands upon laboratory services such as microbiology. There is also increasing use of microbiology by family doctors: in 1985/86 some 27 per cent of tests were carried out at the request of GPs.

Table 1 Specimens examined in regional and area laboratories, 1985/86

Source	Examination	No of Specimens	Totals
Human	**For bacteria**		
	In urine	2,192,007	
	For tubercle bacilli	149,715	
	For other bacteria and fungi	2,640,872	4,982,594
	For chlamydia and viruses (including by electron microscopy)	330,993	330,993
	Antigen-antibody detection		
	In venereal diseases	417,192	
	In bacterial diseases	123,355	
	In viral and other diseases	1,105,427	1,645,974
	Antimicrobial assays	41,777	41,777
Animal	**Diagnosis of diseases**	5,708	5,708
Food	**For microbial contamination**		
	Water, milk, cream, ice cream	160,376	
	Other foods	48,820	
Other environmental specimens		72,197	281,393
Various reference specimens		102,090	102,090
Grand total			7,390,529

This trend may reflect a number of influences, but is certainly one consequence of the shorter duration of in-patient stay in hospitals; tests formerly done in hospitals are now often carried out before admission or after discharge.

Growth in specimen numbers places particular demands upon microbiology laboratories, where much of the work cannot as yet be automated and remains dependent upon skilled staff. Thus an explicit general feature of the annual reports provided by the Directors of the PHLS Area and Regional laboratories for the year 1985/86 is the pressure upon staff and the concern created by the growing demands upon laboratories in the face of financial restrictions. In recent years these have had severe effects upon laboratories. Staff have responded to these pressures with increases in efficiency, by making all possible economies, and by means of automated methods whenever feasible. Notwithstanding these pressures, the PHLS has responded vigorously to major challenges, such as AIDS or the *Salmonella ealing* episode (page 63), and staff continue to demonstrate an investigative approach to laboratory and field work. However, there is real concern over the effects of financial pressures upon the work of the PHLS and its flexibility in response to new demands.

The total of specimens examined included over 100,000 reference specimens, representing tests for particular pathogens which are dealt with by a specialist reference laboratory, or by a peripheral laboratory acting as a reference centre for a group of pathogens (Table 2, over page). By this means, individual laboratories maintain a high level of expertise in the infection concerned, and the PHLS provides reference services economically for the whole country.

The total of environmental specimens in Table 1 mainly refers to milks, waters and foods, but this by no means includes all the community public health work of PHLS laboratories. The total omits numerous samples collected from patients or contacts involved in outbreaks in schools, nurseries, old peoples' homes or the community generally; also samples studied in connection with, for example, vaccine surveillance, epidemiological investigations and research. A most important factor not reflected in specimen numbers is the time spent by laboratory Directors and staff upon environmental health matters—in giving advice, visiting sites and in discussing problems, samples and control measures with MOsEH, EHOs and colleagues in CDSC and PHLS reference laboratories. Such activities, which are essential in maintaining control of infection and communicable disease, are an invaluable but unquantified part of the work of PHLS laboratories.

Table 2 Specimens examined by non-CPHL reference and special laboratories and units, 1985/86

Laboratory and specimen type	Numbers examined
Special Pathogens Reference Laboratory, CAMR	
Arbovirus serology	558
Viral haemorrhagic fevers:	
virus isolation	40
serology	147
Rickettsias and Coxiella:	
serology	508
isolation	8
Hantaan:	
serology	551
isolation	88
PHLS Anaerobe Reference Unit	
Cultures for identification	442
Specimens for *Clostridium difficile* toxin	116
PHLS Gonococcus Reference Unit	
Cultures	2,324
Serology	549
PHLS Leptospira Reference Unit	
Serology	3,396
Specimens for isolation and identification	347
PHLS Malaria Reference Laboratory	
Blood films for malaria parasites	1,486
Other	880
PHLS Mycobacterium Reference Unit	
Cultures for identification	3,809
Specimens for isolation	12,136

Area and regional laboratories

Against the constant background of day-to-day diagnostic work, PHLS laboratories are frequently involved in special studies and investigations. Such activities are illustrated by the following examples.

PHL Bristol collaborated with **PHL Plymouth** and clinicians at the Plymouth Eye Infirmary in a double blind, placebo-controlled trial of topical human fibroblast interferon treatment of adenovirus 8 conjunctivitis. The conclusions reached were that interferon probably made little difference and containment of outbreaks must continue to depend upon control of infection measures. The laboratory was also involved in the study and control of echovirus 6 infection in a special care baby unit by means of treatment with human normal immunoglobulin. A monoclonal antibody immunofluorescent method for detection of *Chlamydia trachomatis* has been evaluated and is now in routine use, permitting rapid diagnosis and, consequently, more effective treatment of cases and propyhlaxis in contacts.

An outbreak of giardiasis was recognised in south-west Bristol in the summer of 1985. Epidemiological investigations with CDSC revealed that the distribution of cases was localised to an area supplied by one water main. A significant association was demonstrated between mains water and the infection. Because filtration of the water supply was found satisfactory, post-filtration contamination is believed to have been the cause. The water main to the affected area had been repaired shortly before the outbreak. This is the first clear evidence of spread of giardiasis by British public water supplies; implications for the water industry are being assessed by the Department of the Environment.

PHL Cambridge, with CDSC, the Division of Enteric Pathogens (at CPHL), and **PHL Norwich** provided the first report from the UK of a community outbreak of haemorrhagic colitis due to a strain of *Escherichia coli* 0157:H7 which produced verotoxin. There were some 50 cases of which 17 were admitted to hospital, with one death. The source was probably contaminated raw vegetables. Extensive study of *Toxoplasma gondii* infections in heart transplant recipients has led to the successful use of pyrimethamine in prophylaxis of sero-negative individuals receiving transplants from antibody positive donors.

PHL Cardiff investigated outbreaks of shigellosis, hepatitis B in drug abusers, psittacosis and cryptosporidiosis. There was evidence of case-to-case transmission of shingles in a large office in Swansea. Some 15 PHLS laboratories are collaborating with Dr Stephen Palmer (Consultant Epidemiologist at PHL Cardiff) and **PHL Rhyl** to study the incidence, epidemiology and clinical and microbiological features of cryptosporidiosis, which is being reported with increasing frequency. The infection, caused by a protozoan parasite, particularly affects young children, causing foul-smelling diarrhoea, abdominal pains, vomiting, anorexia and weight loss. The infection also affects domestic and other animals. There are wide differences in the incidences reported by different PHLS laboratories. The basic epidemiology of the infection has not yet been established, but spread by milk and unfiltered water is suggested. An outbreak of cryptosporidiosis during December and January was studied by **PHL Epsom** with CDSC. It affected about 40 people and appears to have been caused by tap water from a particular source. Another outbreak of cryptosporidiosis, which was also associated with campylobacter infection, was traced at **PHL Exeter** to the consumption of raw milk at a show dairy on a North Devon farm.

PHL Central Middlesex Hospital was concerned with two outbreaks in London hotels of gastroenteritis, investigated with staff from CDSC. Both were associated with a single food handler who appeared to be a long term carrier of the small, round, structured virus associated with the outbreak. There is also collaboration with the Bacterial Metabolism Research Unit (at CAMR) and the MRC Common Cold Research Unit in studies of the effect of enteric virus infection on the bowel flora, and with the Institute of Child Health on trials of rotavirus vaccine.

At **PHL Chester** an investigation of farmhouse produced goat cheese has shown that, while unpasteurised milk was bacteriologically satisfactory, the cheese may have a very high level of coliform and *E coli* counts indicating a significant potential risk to consumers.

PHL Coventry traced an outbreak of *Klebsiella* bacteraemia in leukaemic patients to a contaminated mixer used to prepare special diets. Surveillance continued this year of convalescent salmonella excreters from a food poisoning outbreak which affected hospital staff at the end of 1984/85. Despite the fact that staff were allowed back to work when they had been free of symptoms for 48 hours, secondary cases did not occur.

PHL Gloucester is heavily engaged in epidemiological and microbiological studies of meningococcal infection, particularly in relation to the current relatively high incidence of Group B infection in the Stroud area. It is also engaged in a prospective study of several hundred patients to explore the relationship between *Campylobacter pyloridis* and gastritis.

PHL Guildford maintains a particular interest in the prevention of gastroenteritis in British holidaymakers in resorts in Spain and Portugal, and works in close association with the local health officials, and also with Thomson Holidays Ltd, who have been most supportive of this work. Collaboration with authorities in the Algarve resulted in much work upon the local water and sewage systems which was associated with an estimated decline in the incidence of gastroenteritis in holidaymakers from 70 per cent in September 1984 to 15 per cent in September 1985. The **Influenza Research Unit** at Guildford is continuing its studies on the epidemiology of influenza in school children in collaboration with school medical officers. Investigation of two cases of Legionnaires' disease led to the isolation of the organism from a water cooling unit used in a plastic pressing machine near which both patients had worked.

PHL Lincoln investigated, with support from CDSC and **PHL Leeds**, an outbreak of Legionnaires' disease in the county police headquarters which affected 6 of 40 staff working in an air-conditioned wing. Two elderly people in nearby houses were also affected. Fortunately, only one patient required hospital admission, although two patients required re-admission some weeks later suffering from pneumococcal pneumonia. The outbreak was attributed to a cooling tower which had been treated with biocides but not cleaned for two years.

PHL Manchester screened many contacts of a child recently returned from Bangladesh infected with toxigenic *Corynebacterium diphtheriae var gravis*. Similar incidents were handled by **PHL Dulwich** and **PHL Luton**, and illustrate the need for constant vigilance against imported infection. A prospective study of enterovirus infection in day nursery children has revealed a high prevalence of giardiasis, campylobacter, enteropathogenic *E coli* and calicivirus infection, often with little associated clinical illness. Work at **PHL Manchester** includes the

development of monoclonal serotyping reagents for Group B meningococci, and the development of restriction endonuclease fingerprinting techniques to support epidemiological studies. Fetal infection with rubella virus is under study and offers the possibility of developing pre-natal diagnostic methods by examination of chorionic biopsy material. Work on varicella zoster virus infection in pregnancy indicates that the chance of the fetus becoming infected increases to reach a level of 50 per cent in the last month.

PHL Newcastle has a particular interest in Legionella and, like **PHL Birmingham**, is examining various methods of cooling tower treatment, including continuous chlorination and the effects of biocides. It also handled numerous specimens in an outbreak of salmonella infection in schools some 40 miles distant from Newcastle, which affected several hundred children.

PHL Norwich is very active in applying computing methods to data handling and reporting in the laboratory, in particular the use of MICROLAB (see page 58). Studies on autoclaves have been extended to the use of low temperature steam with formaldehyde.

PHL Preston did much serological work in connection with the Stafford Legionella outbreak (see page 26) and was closely involved in the *salmonella ealing* episode at Kendal (see page 63). Staff investigated an outbreak of *S enteritidis* infection in a pyscho-geriatric hospital with person-to-person spread among patients and staff. Campylobacter in several families was traced to puppies distributed from the same litter. Work on the survival of campylobacter on hands showed that the organism can remain alive for long periods in the presence of chicken liquor; adequate drying of the hands following washing was essential for removal. Study of farm pasteurisers has shown frequent recontamination after heat treatment.

PHL Southampton has a particular interest in campylobacter infections and has been involved with the study of a number of outbreaks, including one (with **PHL Poole**) traced to a catering training establishment where cross contamination between foods was inadequately controlled. Gastroenteritis among the passengers and crew of cruise liners has required much attention.

PHL Taunton was involved in the investigation and control of a large outbreak of *S panama* food poisoning in a district hospital 26 miles away. During a meningitis episode in a military camp, some 2,500 personnel were swabbed, of whom 25 per cent carried meningococci in their upper respiratory tract.

PHL Truro studied an extensive rotavirus outbreak in Cornwall, the laboratory testing for which was supported by **PHL Bristol**, and has surveyed private water supplies in Cornwall. EEC legislation has resulted in a considerable increase in the examination of private waters submitted

by District Councils; these new regulations have affected many laboratories.

Gonococcus Reference Unit (PHL Bristol) provides a reference service which includes plasmid typing for all penicillinase-producing gonococci. The unit has observed a national decrease in the number of penicillinase-producing gonococci, but an increase in chromosomally resistant strains which, no doubt, will produce problems in the years to come.

Mycobacterium Reference Unit (PHL Cardiff) has seen no decrease in its reference work, despite the decline in the incidence of tuberculosis nationally. This is in part due to an increasing number of opportunistic mycobacterial infections, including cases in AIDS patients. Antimicrobial sensitivity testing of isolates remains an important area of work, and the growing use of short course treatment regimens for lymph node tuberculosis has led to increased testing for pyrazinamide sensitivity. The unit is collaborating in studies of short-course chemotherapy of lymph node tuberculosis, and in leprosy vaccine studies in Malawi.

Leptospirosis Reference Unit (PHL Hereford) is engaged in a range of research activities, including technical studies to improve the detection of infection serologically and by culture. An antibody survey among farm workers in Herefordshire, Derbyshire and Cheshire, in collaboration with the Health and Safety Executive, revealed that as many as 11 per cent showed evidence of past *L hardjo* infection. The unit is also developing the capacity to type strains and undertake serology of Lyme disease.

Anaerobic Reference Unit (PHL Luton) undertakes reference identification work on anaerobic bacteria, including *Actinomyces* species isolated in NHS and PHLS laboratories. The unit also undertakes examination of stool specimens for *Clostridium difficile* by culture and toxigenicity testing. It provides advice on all aspects of clinical anaerobic bacteriology and works on equipment and methodology. A course is provided each year on anaerobic bacteriology for MSc students of the London School of Hygiene and Tropical Medicine, and a number of visiting workers are accepted for training from the UK and abroad. Its range of research activities includes work on the role of anaerobes in, and the treatment of, infected pressure and chronic venous ulcers.

AIDS

The world-wide pandemic of infection with the AIDS virus (LAV/HTLVIII virus, but now renamed the human immunodeficiency virus, HIV) continued to have a growing effect upon the UK (Figure 3). In the year 1 April 1985 to 31 March 1986 a total of 188 cases of AIDS were notified to CDSC from all parts of the UK, although four out of every five of the patients were notified from the London NHS Regions. Of the 328 cases reported in the UK up to 31 March 1986, 54 per cent have proved fatal. The serological testing service provided for England and Wales by the PHLS and by a number of NHS virus laboratories had identified by 31 March 1986, 2,543 infected individuals, 30 per cent from the London Regions (Figure 4, over page).

A fuller account of AIDS work in the PHLS is given on page 55, but it must be emphasised that the AIDS pandemic is extremely serious and work upon it is accorded high priority by the PHLS. The infection will continue to spread and to cause death until means of prevention and treatment are found. It will place growing demands upon many aspects of the NHS and not least upon microbiology laboratories. HIV infection induces immunosuppression and patients become highly susceptible to other pathogens and to organisms which only rarely attack healthy people. These infectious complications of the primary disease need to be diagnosed and treated, but the specimens taken for diagnostic purposes must be handled in the laboratory with the care appropriate to samples which may also contain HIV. Control at present depends upon preventing

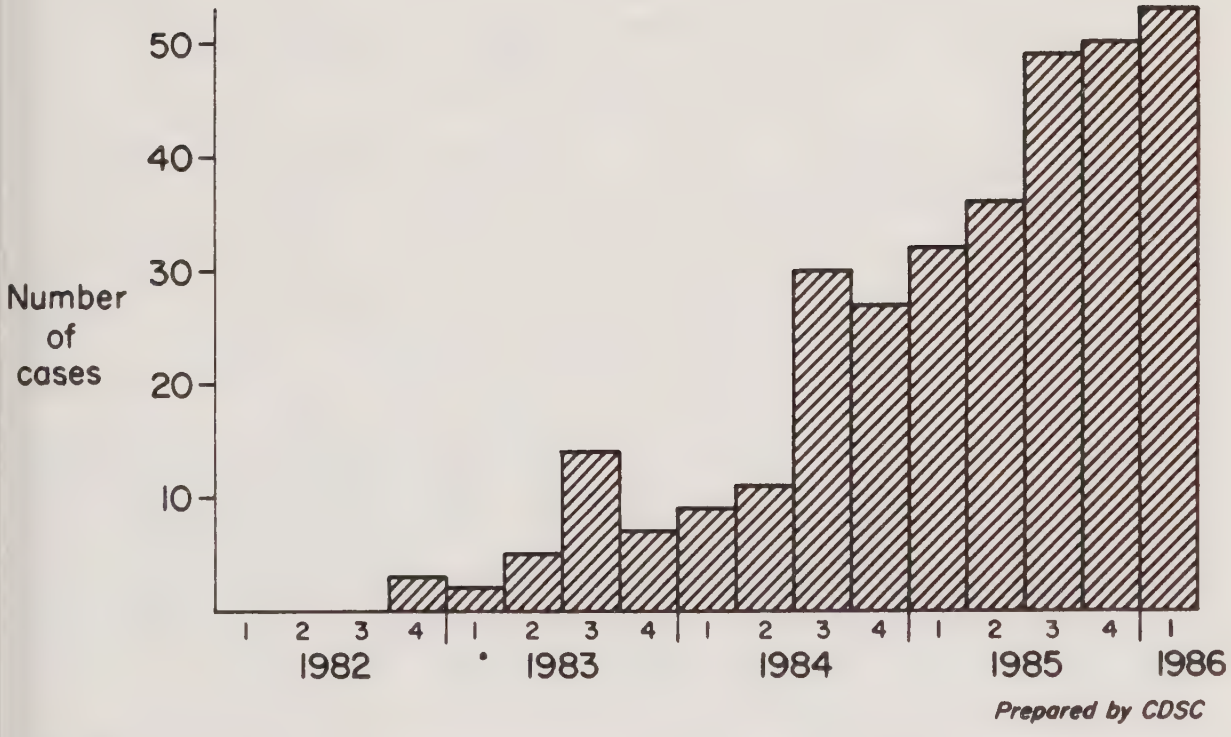


Figure 3 Cases of AIDS in the UK by quarter of reporting. Includes cases reported to Communicable Disease (Scotland) Unit

Figure 4 HIV antibody positives in NHS Regions to 31 March 1986

transmission of the infection. Epidemiological studies have established that the mode of spread is almost entirely by sexual, and especially homosexual, intercourse and the injection of contaminated blood or blood products. So the methods of control are clear and include, especially, the avoidance of sexual promiscuity and the use of contaminated needles and syringes by drug addicts and others.

Salmonellosis

Food poisoning due to the various serotypes of salmonella continues to require a great deal of attention from the PHLS. A major source remains chicken and cattle, compounded by intensive rearing and country-wide distribution of meat and animal products from single producers. Prevention depends heavily upon good hygiene in the kitchen, and the efforts of Environmental Health Departments to promote good practices in kitchens serving the public. The introduction of irradiation for poultry and other food, if eventually approved by government, should help to reduce the load of illness and death from salmonellosis. The consumption of raw milk, now largely prevented in Scotland, continues to give rise to outbreaks of infection in England and Wales.

The year saw the publication of the report of the Committee of Inquiry into the *Salmonella typhimurium* outbreak at the Stanley Royd Hospital, Wakefield in 1984. The report recommends that the expert assistance of the local PHLS laboratory and of the CDSC be called upon early in major outbreaks. All who become involved in outbreaks or potential outbreaks of infection should appreciate that they can and should call upon the PHLS for support, advice and help at an early stage.

The PHLS averted what could have been a major tragedy in 1985 due to the contamination of dried, powdered baby milk with *S ealing*. There were, thankfully, no more than 40 cases in babies in different parts of the country, undoubtedly because the level of contamination in retail packages was low; the PHLS Food Hygiene Laboratory estimated that the final product contained less than two salmonella organisms per 450 gm pack. However, reconstituted dried milk provides an excellent culture medium, so that milk not used shortly after reconstitution could become heavily infected with a pathogen that can easily prove fatal to young babies. An account of the episode is given on page 63.

Meningococcal meningitis

Although meningitis and cerebrospinal fever due to *Neisseria meningitidis* are relatively uncommon in the UK, the infection is very serious unless promptly treated and carries a mortality which may be as high as 10 per cent. Periods of increased prevalence occur from time to time and we appear to be at the start of such a period at present. A careful estimate made by Dr Goldacre in 1976 suggested that 1 child in 1,500 could develop clinical infection by the age of ten, but the rate in some parts of the country currently appears to be about four times greater. A particularly worrying feature concerns sulphonomide-resistant Group B strains, one serotype of which has become the cause of some persistent outbreaks in the last few years, notably in the Stroud, Plymouth and Merseyside areas. Although vaccines effective against the other important sero-groups of meningococci (A,C,Y and W-135) have been developed, this has not yet proved possible, despite much international research, for Group B which is the commonest sero-group in the UK and many other countries.

The outbreaks are also unusual epidemiologically. Carriage rates of the serotype involved are low, and an unusually high proportion of cases are among teenagers. The infections are being closely studied by Manchester PHL (which is responsible for PHLS meningococcal reference work), Gloucester PHL and CDSC. Collaborative work to develop a vaccine for clinical trial has also begun at CAMR. Control of Group B infections at present depends primarily upon maintaining a high awareness of the disease and the early use of antibiotics in suspected cases. Chemoprophylaxis has a place for circumscribed groups of close contacts—in households and residential schools, for example.

Legionellosis

There was a major outbreak of legionellosis in Stafford in April 1985. A total of 101 cases was identified and there were 8 deaths. Intensive investigations by epidemiologists from CDSC, in association with local staff, CAMR, and PHLS laboratories at Birmingham, Manchester and Preston, established that the source was the Stafford District General Hospital and in particular its air-conditioning system. The episode highlighted the growing reliance of health and local authorities on the PHLS in matters concerning outbreaks and infection control, and also the need to strengthen PHLS resources for such work. The outbreak severely stretched the PHLS, and especially CDSC. The Birmingham PHL, for example, which first isolated the pathogen from post-mortem lung material, dealt with 3,300 sera for antibody tests, 500 samples of waters and other environmental specimens, and 36 post-mortem lung samples.

Reye's syndrome

The PHLS supports a fruitful collaboration between the CDSC and the British Paediatric Association. Based upon this collaboration, Dr Susan Hall has studied Reye's syndrome, a rare but serious childhood illness characterised by encephalopathy and hepatitis. The syndrome is associated with recent infections, and chicken-pox and influenza have been particularly incriminated in other countries. Evidence, especially from the USA, suggested that aspirin consumption may add to the risk. Dr Hall's analysis indicated that such an association might also exist in the UK, although there were appreciable differences from the findings reported from the USA. For example, the age distribution of cases was wider in the UK and there was no clear association with particular infections. The findings were instrumental in leading to the withdrawal of childhood aspirin from general sale in the UK.

Central Public Health Laboratory

The move to New Colindale was completed in June 1985, and the next six months were spent settling into the new laboratories and dealing with the teething troubles of a technically complex building. The end of this first phase of adjustment came in December. It was marked most appropriately by the official opening of the new CPHL by the Queen, who then toured the building and inspected the demonstrations before taking tea with some 50 of the staff drawn from all departments, disciplines and grades.

Right from the start of the move, the morale of everyone in CPHL rose sharply and has remained high. New Colindale is a delightful building in which to work. There have, of course, been difficulties and defects, most of which like the inadequate electricity supply and the erratic heating and ventilation have been righted. At the time of the move, neither the Category 4 laboratory nor the electron microscopy suite was ready. Both are now finished and functioning.

The plans had always looked complicated and it was revealing to match them to reality. The apparently simple basic concept of three overlapping rectangles, each with its own racetrack pattern of corridors, in fact produces a maze which only time and a map allow one to penetrate with any confidence. It gets easier as the different laboratories develop their own individualities of people, posters and plants.

Two drawbacks are attributable to early planning decisions. Now that the ventilation is reasonably balanced, the laboratories are comfortable; but the sealed windows and numerous extractor fans exact a price in complexity of control and in heat loss. The decision to allow individual directors to design their own departments within a broad basic framework has made the building somewhat inflexible when the need to move laboratories arises.

The lecture theatre and seminar room have allowed bigger audiences for the external lecture programme. The lecture theatre is particular provides a relaxed and intimate atmosphere which encourages discussion even at large formal meetings. A number of outside bodies have now used both the meeting and catering facilities. They have all been very satisfied and the demand is growing.

Division of Enteric Pathogens

The overall number of cultures dealt with fell by 10 per cent (Table 4, over page), partly as the transfer of local salmonella reference work to the Scottish Salmonella Reference Laboratory was completed. The most striking single incident during the year was the detection of an unusual number of *Salmonella ealing* infections in babies, an observation which led to the temporary but costly closure of the Farley dried milk powder factory.

The micro-biochemical system introduced last year for the diagnosis of *Salmonellae* has proved very successful and economical. Development of

Table 4 Specimens examined at the CPHL, 1985/86

Laboratory and specimen type	Source of specimens PHLS	NHS	Other UK	Foreign
Division of Enteric Pathogens				
Cultures	8,342	10,859	3,622	1,841
Sera		7		
Division of Hospital Infection				
Cultures (staphylococci)	2,059	8,948	126	618
Cultures (streptococci)	3,186	4,495	74	142
Cultures (gram-negative bacilli)	761	2,025	26	289
Cultures (Antibiotic Reference Lab)	674	3,205	8	532
Sub total	6,680	18,671	234	1,581
Division of Microbiological Reagents and Quality Control				
Sera	503	482	18	64
Food Hygiene Laboratory				
Cultures and/or specimens	1,614	945	1,804	172
Mycological Reference Laboratory				
Cultures	294	1,427	75	63
Serology	432	2,777	88	103
Anti-fungal assays	84	339	5	7
Other	15	29	9	1
National Collection of Type Cultures				
Cultures	322	394	44	128
Virus Reference Laboratory				
Cultures	761	363	50	63
Sera	11,044	15,106	2,634	1,072
Other	432	267	73	14
Sub total	12,237	15,736	2,757	1,149
Viral Zoonoses Laboratory				
Sera			1,950	

similar systems for *Escherichia coli* and *Shigellae* is progressing.

Problems of antibiotic resistance continue. The multi-resistant strain of *S typhimurium*, phage type 204c, is now also resistant to gentamicin, probably owing to increased veterinary use of apramycin. Approximately 0.5 per cent of strains of *S typhi* isolated here are resistant to chloramphenicol, half of them to a clinically significant level. Some 35 per cent of shigella strains of subgroups A B and C isolated in England and Wales are resistant to trimethoprim. Strains resistant to nalidixic acid have appeared in Africa.

Reference facilities are now offered for Vibrios (*V cholerae*, *Aeromonas* and *Plesiomonas*) and *Yersinia enterocolitica*, but not yet for campylobacters, though work on their serology and phage typing is going on.

Research continues on verotoxin, colonisation and adhesive factors in *E coli*. Genetic studies have allowed the development of a number of

probes. New ELISA techniques are being developed. These and restriction enzyme plasmid analysis have already proved useful in diagnosis and epidemiology. For example, a joint study has begun to look at verotoxin positive strains of *E coli* of various O groups in relation to the haemolytic uraemic syndrome. The verotoxin probes developed in the Division were also used to investigate an outbreak of haemorrhagic colitis in East Anglia.

Division of Hospital Infection

This was the first full year of the Antibiotic Reference Laboratory, which has been setting up and developing its methods. It now does much of the resistance testing of the Division, working in conjunction with the individual organism-based laboratories. Plasmid analysis in relation to the epidemiology of antibiotic resistance in hospital infections is being developed rapidly, together with a genetic analysis of the epidemic methicillin-resistant strains of *Staphylococcus aureus* (EMRSA).

Pseudomonas aeruginosa typing for surveillance of high risk units in hospitals increased slightly during the year, though most outbreaks were small. The typing service provided for other gram negative organisms has a small but clinically significant usage. The two-year survey of sputum bacteriology in adults with cystic fibrosis has been completed. Variants of *Pseudomonas aeruginosa* with altered lipopolysaccharides were found and investigated. On testing commercially produced monoclonal antibodies to *P aeruginosa*, some appeared to be potentially valuable for diagnosis or therapy and are being evaluated further. New stocks of typing sera for *Klebsiella pneumoniae* were produced and a phage typing scheme is being developed.

The Hospital Hygiene Unit dealt with numerous enquiries and was called in to advise on microbiological problems of operating theatres, isolation and shared treatment facilities. It also developed computer programmes for other laboratories in the Division: to link antibiotic resistance, typing characteristics and epidemiological factors concerning organisms received by the Antibiotic Reference Laboratory, for the National Survey of Antimicrobial Resistance, and for an international survey of methicillin-resistant staphylococci. Several types of monitors for the control of the cold chain were teted for the WHO extended immunisation programme.

The epidemic of methicillin-resistant *Staph aureus* continues unabated. Their phage typing and other characteristics are being investigated. Staphylococci from patients with toxic shock syndrome were phage typed and, in collaboration with the Food Hygiene Laboratory, examined for toxin production. It may become possible to distinguish two syndromes, but further work is needed. Coagulase negative *Staph aureus* is of increasing clinical importance, both in itself as a pathogen and as a potential source of antibiotic resistance genes. Collaborative studies continue with a number of hospitals, but are becoming increasingly difficult to maintain with present staff numbers.

There has been an increase in the number of invasive infections associated with *Streptococcus pyogenes* strains of type M1. New serotyping methods for streptococci have been useful in outbreaks in hospitals and clinics. Pneumococci are rarely resistant to antibiotics and since 1977 only one or two strains, all of type 23, have been referred for examination each year. This year over 30 multiply resistant strains have been received from hospitals throughout the UK. Most, though not all, were type 23.

In conjunction with the Mycology Reference Laboratory, attempts are being made to improve methods of typing *Candida albicans*, which is becoming of increasing clinical importance in intensive care and special care baby units.

Division of Microbiological Reagents and Quality Control

This was the first full year in which the NHS has been charged for reagents. PHLS laboratories were also charged. Although only part of this represents real income to the PHLS, it is hoped that by letting the costs fall on the users they will be encouraged to economise.

Nearly 1,800 ELISA kits were issued for the detection of rotavirus, hepatitis A antigen and antibody, and hepatitis B 'e' antigen. ELISA kits were issued to Public Health Laboratories only and were not charged for. An extended range of reagents for the identification and serotyping of *Legionellae* was made available to all laboratories.

The division remains a WHO reference centre for rapid virus diagnosis.

Monoclonal antibodies have been produced against *Legionella*, *Listeria* and *Chlamydia* strains in order to develop better typing and diagnostic methods. DNA/RNA probes for *Legionellae* are being developed.

An ELISA for the detection of IgG antibody to Rubella virus has reached the stage of field trials. ELISAs for detecting IgM and IgG antibody to cytomegalovirus have been developed and evaluated and will be issued when large scale production of antigen is possible.

Monoclonal antibodies to adenovirus, already produced, are being assessed for the detection of viral antigen directly in clinical material as well as in tissue culture. A number of monoclonal antibodies are being produced in conjunction with other laboratories in CPHL.

Under the National Quality Assessment Scheme, microbiology laboratories in the UK were sent 27 distributions involving 109 separate specimens. A major effort has been put into work on the human immunodeficiency virus (HIV, formerly LAV/HTLVIII), in close collaboration with the AIDS unit of the Virus Reference Laboratory. Two reference sera and four calibration panels of sera have been issued to diagnostic laboratories and to laboratories of the Blood Transfusion Service. These have been invaluable in attaining and maintaining a high level of accuracy and reliability in AIDS serology throughout the country. Obtaining adequate supplies of suitable sera remains a problem. Two ELISAs for the detection of anti-HIV have been developed and should provide useful confirmatory tests for diagnosis.

Food Hygiene Laboratory

Cultures and specimens were received from laboratories throughout England and Wales and from countries as far apart as Bulgaria, Australia and St Helena. The total was up by 12 per cent, though the number of foreign samples was only a third of that received last year. The most striking outbreak of the year was that due to *S ealing* in infant feeds, an episode which showed the value of close collaboration among the Division of Enteric Pathogens, the Food Hygiene Laboratory, CDSC and Public Health Laboratories throughout the country.

Following the isolation of *Listeria monocytogenes* from cheese and the possibility of its growth at low temperatures, new methods are being assessed and a survey of cheeses from the Mediterranean area will be undertaken. Research continues on various aspects of the pathogenic potential of *Bacillus subtilis* and *B cereus*. There is evidence of immunologically distinct subunits in the molecule of *B cereus* enterotoxin.

Work continued on the development and evaluation of rapid *in vitro* methods for detecting toxins from *Clostridia* and *Staphylococci*. Preliminary studies on infant botulism were begun.

The survey of the bacteriological condition of airline meals continues. Main dishes and desserts appear to be less of a problem than the cold starter dishes.

Hepatitis Epidemiology Unit

Studies of hepatitis B continue. The risk of transmission of hepatitis B from staff to patients is now rare as a result of the adoption and monitoring of strict control procedures. The small risk that remains could be eliminated by careful attention to asepsis and by immunisation of appropriate staff. Reports of acute hepatitis B almost doubled between the years 1980 and 1984, largely due to an increase in drug-associated cases. Follow-up at one year of infants who were at risk of hepatitis B virus infection shows that immunoglobulin had prevented a carrier state in 89 per cent. However, few developed active immunity.

Of necessity, hepatitis studies were overshadowed by work on AIDS. The survey of AIDS in clinics for sexually transmitted disease was extended during the year from two (pilot) centres to nine, and will be extended further, while the number of heterosexuals examined will be increased. The study is regarded as being the most sensitive available indicator of the degree of spread of HIV infection out of the currently recognised high risk groups.

Mycological Reference Laboratory

The laboratory moved to Colindale from the London School of Hygiene and Tropical Medicine in March 1985 and has settled down well in spite of the inevitable upheaval and a large number of staff changes. Links with the School are being maintained. The laboratory also looks after the

National Collection of Pathogenic Fungi and is establishing close collaboration with the National Collection of Type Cultures.

The numbers of enquiries and submissions of materials and cultures for mycological tests continues to rise, in part due to the increasing importance of fungal infections in association with immunosuppression from treatment or in disease—including AIDS. An increasing number of requests for assays of antifungal agents are being received. Work continues on the antigenic composition of a number of pathogenic fungi and on the detection of antigenaemia in patients with aspergillosis and paracoccidioidomycosis.

In collaboration with the Division of Hospital Infection, work has begun on improving typing systems for *Candida albicans*.

National Collection of Type Cultures (NCTC)

There was a 14 per cent increase in the number of cultures issued during the year, and the proportion going overseas rose from 24 per cent to 33 per cent. Taken with an increase in unit price, this resulted in a 30 per cent increase in income generated. The number of cultures sent for identification rose slightly, but the number of new accessions fell sharply, except to the newly instituted plasmid collection. The other new addition was the transfer of *Mycoplasma* reference facilities here from the Norwich Public Health Laboratory.

Under a scheme sponsored by the Laboratory of the Government Chemist, the data on strains in the NCTC catalogue are being transferred to computer files and will form part of an information system covering all UK culture collections.

The EEC is supporting joint projects between the NCTC and the West German Culture Collection on plasmids and between the NCTC, the University of Ghent, the Pasteur Institute (Paris) and the Royal Postgraduate Medical School, on the taxonomic and diagnostic use of gel electrophoresis of bacterial proteins. The analysis of proteins and DNA from campylobacters has proved very fruitful and similar techniques are being applied to a number of difficult genera. Computer programmes are being developed to link such analytical data to produce classification matrices.

Virus Reference Laboratory

The year has been dominated by the demand for work on AIDS. The demand for serological tests was very great (Table 4), although with the introduction of kits to laboratories throughout the country, primary testing is requested less frequently. Confirmation of positive or investigation of doubtful results continues to provide much work. A major undertaking was the evaluation of commercially available kits for the DHSS. Although the DHSS provided resources for extra staff, a considerable load fell and remains on the senior people responsible for the AIDS work. Since most commercial kits for detecting antibody to the human immunodeficiency virus (HIV) are simple antiglobulin tests,

confirmation is best done with competitive or gamma-capture tests, and a number of these have been developed. There has been good collaboration with the Division of Microbiological Reagents and Quality Control and the Blood Transfusion Service. Second generation tests are now being evaluated, while work is going on to develop virus and antigen detection techniques for routine use. There are collaborative studies with a number of epidemiological projects.

The first stage of work on inactivation of hepatitis A virus in shell-fish has been completed and will allow control regulations to be laid down. Better techniques for monitoring inactivation are now being developed. Work continues in conjunction with the Hepatitis Epidemiology Unit's study of prophylaxis of hepatitis B in infants born to carrier mothers. Serological study of influenza virus and surveillance of antigenic changes continues. Interest in human parvovirus B19 continues to grow. As well as collaborative work to investigate its relation to arthritis, attempts were being made to clone some genes to provide a better source of antigen. Work continues on polyomavirus in relation to renal infection in children, iatrogenically immunosuppressed patients and those with HIV infection.

The techniques of molecular biology introduced a few years ago continue to grow and the new procedures are being applied as widely as limited resources allow. Molecular hybridisation techniques are being developed for the detection of papillomavirus DNA in tissue biopsies. Tumour virology is likely to grow.

In spite of structural delays and difficulties the Electron Microscopy Unit maintained its supportive work for the Virus Reference Laboratory and others.

Viral Zoonoses Laboratory

The Laboratory opened with a staff of three. During the year it took on a senior scientist, but lost the consultant virologist in charge, who was offered an attractive post at CDC Atlanta. The P4 containment laboratory for the diagnosis of viral haemorrhagic fevers, which is the *raison d'être* of the VZL, was finished, equipped, commissioned and approved by the Health and Safety Executive.

In order to facilitate the production of safe diagnostic reagents, gamma irradiation inactivation curves are being constructed for the dangerous pathogens of concern to VZL. Inactivated virus will also be used to produce monoclonal antibodies and an encouraging start has been made with herpes B virus. The laboratory has taken on the responsibility for testing primate serum for the presence of antibodies to the simian herpes B virus. The standard methods are being used, while the Medical Research Council has given a grant for work to develop new ones. The dot immunobinding assay for B virus antibodies, developed at the WHO Collaborating Centre in Texas, was evaluated but has limitations of sensitivity and specificity.

Professor AA Glynn

Communicable Disease Surveillance Centre

The year was dominated by the development of the epidemic of the acquired immunodeficiency syndrome (AIDS) and by a large outbreak of legionella pneumonia which took place in Stafford District General Hospital in April.

The integration of the Communicable Disease Surveillance Centre (CDSC) and the Epidemiological Research Laboratory (ERL) failed to progress as planned, partly because of the uncertainty about the future of PHLS and CDSC created by the DHSS review of PHLS and partly because of staffing difficulties. When in the autumn of 1985 the Secretary of State for Social Services announced his rejection of the main recommendation to transfer the area and regional laboratories of the PHLS to health authorities, it became possible to consider the future development of the PHLS as a whole, including its role as an epidemiological service. It is in this light that it is intended to plan the central epidemiological component of the service—the new CDSC, combining the previously existing ERL and CDSC—during the next few years.

Surveillance of disease

The CDSC relies heavily on routine data collecting systems for its surveillance function, the most important of which is the national reporting of laboratory diagnosed infections by medical microbiologists from both public health and hospital laboratories. This national laboratory reporting system has four main advantages over other existing routine reporting systems. First, the data are very precise, being based on microbiological diagnoses and the fine typing of organisms; second, the data are often detailed and may include possible sources of infection; third, the data are flexible and allow for comment by the medical microbiologist; fourth, there is relatively quick feed-back of information derived from these data to those locally responsible for disease control. This system has proved invaluable for detecting geographically widespread outbreaks of disease due to the same organism, for monitoring long term trends in infections and for evaluating preventive programmes. Nevertheless, there are deficiencies in this reporting system. First, the data have no denominators either of numbers of specimens examined or of the population sampled; second, the data routinely requested in some infections are so detailed and complex that this militates against complete reporting; third, it is not possible to make use of the output from laboratory computers to reduce the clerical tasks involved; fourth, the central analysis of data is inflexible and it is difficult to undertake ad hoc interrogation of the data base.

In order to overcome these deficiencies, proposals to simplify the data collected were made and pilot studies of a new reporting form in several laboratories were started. It is intended that this simplification will

facilitate the use of laboratory computers to provide automatic reporting which will be more complete and could include denominator data. It will also provide for the development of electronic transmission of data from laboratories to CDSC. At the same time proposals were considered to improve greatly the resources for central analysis of the data (possibly through linkage with the Office of Population Censuses and Surveys, OPCS) to provide more rapid and complete analysis and more readily available tabulations than at present. Linkage with other data centrally collected by OPCS—such as notifications, hospital reports and mortality data—was an important element of these considerations.

AIDS surveillance

The national surveillance of AIDS was begun by CDSC in the summer of 1982, using three sources of data mortality data from OPCS, laboratory reports of opportunistic infections and, most important, a new reporting system from clinicians. These data probably provided an accurate measure of the development of the epidemic of clinical AIDS in time, place and persons at risk, but they gave little information about the spread of the infection. With the development of human immunodeficiency virus (HIV) antibody tests during 1984, it became possible to attempt to obtain such information by the laboratory reporting of confirmed positive antibody tests. This began in the last few months of the year and was developed in 1985 to provide data on trends of HIV infection over time, by risk groups in NHS regions.

Another important development in the surveillance of HIV infection was the establishment with the Association of Medical Microbiologists of a scheme for national reporting and follow-up of health care staff accidentally exposed to infection by needle-stick or other injury while caring for infected patients. Up until the end of 1985, 101 accidental exposures had been reported, none of which resulted in infection, although one infection in a nurse was reported in the literature before the surveillance scheme began.

Paediatric disease surveillance

The very successful Reye's syndrome surveillance scheme organised jointly by CDSC and the British Paediatric Association (BPA) was extended to several other rare diseases including Kawasaki's disease, haemolytic uraemic syndrome and haemorrhagic shock and encephalopathy syndrome. A proposal to set up a joint PHLS/BPA unit (the British Paediatric Surveillance Unit) in 1986 would further develop these clinical reporting systems from paediatricians.

This paediatric reporting system enabled several research projects to be undertaken. One of these was a two-year risk factor study of Reye's syndrome, a preliminary analysis of which showed an association of the syndrome with aspirin medication but no clear link with influenza or varicella as found in the USA. Other research included a risk factor study

of haemorrhagic shock and encephalopathy syndrome and a study of the role of verotoxin-producing *Escherichia coli* in the aetiology of the haemolytic uraemic syndrome.

Field investigation of disease

During the year over 26 major field investigations of outbreaks of communicable disease were undertaken by CDSC epidemiologists in support of Medical Officers for Environmental Health. Usually these were undertaken by full-time PHLS senior registrars in epidemiology or by senior registrars in community medicine on attachment to CDSC, under the supervision of the consultant epidemiologist with responsibility for field investigation. The outbreak of legionellosis in Stafford, referred to elsewhere in this report, was exceptional and required the deployment to Stafford of a consultant epidemiologist and senior registrar for nearly six months after the initial involvement of five medical staff in the first week of the investigation. The demands made upon CDSC in the investigation of this outbreak limited other field investigation, delayed completion of reports on previous outbreaks and led to the postponment of several studies; and indeed, if another major episode had occurred it would not have been possible to provide assistance.

Training and teaching

There were four full-time senior registrars at CDSC in the period under review—Dr Rosalind Stanwell-Smith, Dr Norman Begg, and Dr John Cowden appointed in the autumn, and Dr Tony Ellam who was appointed to a new fourth post. These senior registrars made major contributions to the work of CDSC during the year.

Ten senior registrars in community medicine were attached to CDSC for training during the year, most of them for a period of two months. This training programme, which provided the sort of experience in the field investigation of disease not readily available locally, continued to be popular. Many requests for attachment could not be satisfied, and the waiting list extended to over two years.

CDSC provided a joint in-service training course for Medical Officers for Environmental Health, jointly with Professor David Miller of St Mary's Hospital Medical School. This Environmental Health Workshop was able to make use of the Wilson lecture theatre and facilities in the new Central Public Health Laboratory. As in previous years CDSC staff provided the 'acute community medicine' module of the MSC (Community Medicine) course at the London School of Hygiene and Tropical Medicine. Twenty-three full or half day courses were provided at CDSC for various groups, and 29 foreign visitors spent between half a day and a week at the CDSC. Altogether during the year there were 412 visitors.

Many CDSC staff contributed to undergraduate teaching programmes, mainly in London medical schools, and gave lectures to postgraduate courses and at conferences both in the UK and abroad.

Research

A wide programme of epidemiological research was continued. A pilot case-control study of sporadic cases of salmonellosis and campylobacter infection was carried out with the City of Birmingham Environmental Health Department, although a proposed national study had to be postponed because of other commitments.

A behavioural study of homosexual males showed differences between London and other parts of the country and between the UK and the USA.

Studies of methods of statistical projection of the numbers of cases of AIDS likely to occur and the number requiring health care suggested that the cumulative total of cases would be about 1,837 in 1988, and that there would be about 700 requiring health care during that year.

The rubella monitoring and research programme supported by DHSS continued; preliminary analyses indicated that an acceptable level of control of congenital rubella was unlikely to be achieved by the present vaccination schedule, and mathematical modelling studies were begun to determine the effect of various levels of uptake of vaccine if given to both boys and girls at 15 months of age. Another project supported by the Disabilities Study Unit was begun to discover methods used in districts for measuring vaccine uptake and the reasons for failure to vaccinate.

Other studies of vaccination and immunisation included the follow-up of the participants in the original measles vaccine trials 21 years ago; the study of measles vaccine reactions; the surveillance of subacute sclerosing panencephalitis; examination of the efficacy of zoster immune globulin in the prevention of chickenpox in pregnancy and the neonatal period; the surveillance of BCG vaccine; a case-control study of the efficacy of BCG vaccine given at birth to Asian children; the surveillance of adverse reactions to pertussis vaccine; and the preliminary work for a field trial of acellular pertussis vaccines.

A study of hydatid disease in Wales, supported by DHSS and the Welsh Office, demonstrated a high incidence in South Powys of 7 per 100,000 population per year. A programme to control infestation in dogs has now begun there. An investigation of cryptosporidiosis in England and Wales was started to determine the incidence and possible sources of infection.

The studies of gastric cancer in relation to N-nitroso compounds and in association with gastric surgery were continued with the PHLS Bacterial Metabolism Research Laboratory (CDSC) supported by the Cancer Research Campaign.

Staffing

Dr Bartlett was on sabbatical leave working at the Caribbean Epidemiology Centre until December, and his place was taken by Dr Mary O'Mahony, locum consultant epidemiologist. Dr Susan Hall was appointed consultant epidemiologist in CDSC and senior lecturer in epidemiol-

ogy in the new Department of Epidemiology at the Institute of Child Health. Dr Marian McEvoy continued her secondment from the Northern Regional Health Authority.

Dr Hilary Tillet became head of the statistics and computing section of the amalgamated CDSC and ERL. The statistical and computing requirements of the AIDS surveillance programme and other surveillance programmes, and the detailed investigation of the outbreak of legionellosis in Stafford, have created great pressures upon the statistical staffing of CDSC.

Communicable disease 1985/86

The national epidemic of AIDS continued to increase, and there were more than double the number of cases reported in 1985 than in 1984 and before. There was a large hospital outbreak of legionellosis in Stafford and an outbreak of salmonellosis in babies due to contaminated dried milk, both of which are described elsewhere in this Report. Other features of the year were an expected increase in whooping cough notifications and of laboratory reports of *Mycoplasma pneumoniae* in the autumn which coincided with a rise in infections due to other respiratory pathogens; a widespread outbreak of hepatitis B in intravenous drug abusers; an outbreak of haemorrhagic colitis in East Anglia; a waterborne outbreak of giardiasis in Bristol; the repatriation of a case of Lassa fever from West Africa; a death from cholera; and an investigation of a possible smallpox risk during an excavation of a church crypt in London.

Acquired immune deficiency syndrome The original case definition of AIDS proposed by the Centers of Disease Control, Atlanta, USA and accepted worldwise was revised in June 1985 to take account of the discovery of the causative agent and the recognition of wider clinical manifestations of the infection. This was adopted in the UK from October 1985, but did not affect significantly the national trends.

There were 167 cases reported in 1985, bringing the total reported in the epidemic to 275, with 140 deaths. Most of the cases (79 per cent) were reported by clinicians in the four Thames NHS Regions, a proportion unchanged since the start of the epidemic. Of the 275 cases, 265 were males; 245 (87 per cent) were homosexual or bisexual men, a proportion which also showed no significant change since the beginning of the epidemic; 9 were haemophiliacs; 5 had received blood transfusions, 2 of them abroad; 2 were intravenous drug abusers and a further 2 of the homosexuals were also intravenous drug abusers; 5 were probably heterosexual contacts of infected persons, 1 male in Africa and another in the UK, and 3 females, 1 in Africa and 2 in the UK; of the remaining 9 cases, 5 were in females who had resided in sub-Saharan Africa, 3 were in men who may have been homosexuals or intravenous drug abusers but who denied these risk factors, the last was a woman who cared for a seropositive case at home and may have been infected accidentally by contamination of her eczematous skin lesions.

Sero-epidemiological studies in the UK showed a five-fold rise in the prevalence of HIV antibody amongst British homosexual men attending clinics in London to 21 per cent, and a doubling to 11 per cent in those attending clinics outside London. Of particular concern was a rise in prevalence among intravenous drug abusers from 1.5 per cent to 11 per cent nationally, but with a focus of 51 per cent in Edinburgh. Among haemophiliacs the seroprevalence remained at about 30 per cent. Routine screening of blood donors showed little evidence of spread outside the recognised risk groups: of 604,706 donors tested, 13 were positive and on enquiry 11 of these admitted to being in the recognized risk groups.

Whooping cough Trends in the incidence of whooping cough were monitored by statutory notifications, general practitioner reports and laboratory reports of *Bordetella pertussis*. All showed the expected rise in 1985, four years after the beginning of the previous epidemic. The rise seen by the end of the year 1985 was similar to that in 1981 which preceded the largest recorded outbreak since the 1950s. This suggested that an equally large outbreak might follow in the latter part of 1986 and led to a national campaign to increase the uptake of infant immunisation. The national acceptance rate increased from 64 per cent in 1984 to 65 per cent in 1985 and compared favourably with levels of 40 per cent or less between 1976 and 1980.

Acute respiratory infections The autumn rise in whooping cough in 1985 was accompanied by a rise in *Mycoplasma pneumoniae* infections which usually follow a similar four-year cycle. Other respiratory pathogens also circulated in the population at this time, notably para-influenza virus types 1 and 2 and respiratory syncytial virus, but there were no increases in GP reports of pneumonia, bronchitis and upper respiratory infection to suggest a higher than average incidence of acute respiratory disease for the time of year.

In November 1985 an unusual outbreak of acute respiratory disease due to Coxsackie A21 (Coe) virus was reported in a military training camp. This virus, originally described in 1958 as a cause of upper respiratory infections in military recruits, almost disappeared during the 1960s and 1970s, with 5 or less laboratory reports each year. In 1985 there were 17 reports, 8 of them not associated with the recruit camp.

Hepatitis B A geographically widespread outbreak of hepatitis B infection affecting intravenous drug abusers began in the autumn of 1983, reached a peak in the autumn of 1984 and continued, although declining, throughout 1985.

The national collection of laboratory reports of hepatitis B infection began in the early 1970s, soon after laboratory tests were developed. Acute hepatitis B was defined as a positive antigen or antibody test in a person who had suffered from jaundice within the previous 6 months.

In 1975 there were 1,014 reports; between 1975 and 1980, the annual number ranged between 950 and 1,168 with an annual average of 1,048. The laboratory report forms provided information about possible sources of infection in a little less than half these cases; drug abuse was mentioned in 21 per cent of cases in 1975 and this ranged from 13 to 22 per cent between 1975 and 1980 with an annual average of 18 per cent. A change was observed between 1981 and 1983, when reports increased to 1,200 each year with an increased number of cases being reported with known history of drug abuse.

In the last quarter of 1983 there was a more dramatic increase: reports in that quarter were nearly double those of any previous quarter. The peak of the outbreak was in the last quarter of 1984 when there were 584 reports with a total of 2,004 for the year. The number then fell to reach 386 in the last quarter of 1985 with a total of 1,833 for the year. This outbreak caused particular concern because of the detection of HIV infection in intravenous drug abusers and the possibility of an outbreak of this infection among drug abusers with a subsequent increase in cases of AIDS.

Haemorrhagic colitis This apparently new disease, characterised by the sudden onset of severe abdominal cramps, bloody diarrhoea and either a low grade fever or no fever, first came into prominence in two outbreaks in the USA in 1982. One was in Michigan and the other in Oregon, and both were associated with a verotoxin-producing strain of *Escherichia coli*, 0 157:H7. The outbreaks, comprising at least 37 cases, were linked because in both of them the affected people had eaten at restaurants in the same catering chain. Beefburgers were the common factor and subsequently the same strain of *E coli* was isolated from a sample of this implicated meat product.

The UK saw an outbreak in July 1985, affecting at least 28 people in East Anglia and associated with similar verotoxin-producing strains of *E coli*, 0 157:H7. Most of the cases were adult females. Extensive epidemiological enquiries did not reveal any link with meat products, but there was a statistically significant association with handling locally grown vegetables, particularly potatoes. It was thought possible that these raw vegetables could have been contaminated by farm animals or manure with further transmission during handling in shops or kitchens.

Giardiasis *Giardia lamblia* was recognised as an important cause of acute diarrhoeal illness in the 1960s following outbreaks associated with travel, probably due to contaminated water. The organism has been found in wild animals, beavers and muskrats, which have been suspected as the source of some of the many waterborne outbreaks reported in the USA. However, outbreaks in the UK have been exceptional.

In July 1985 there was a large outbreak of diarrhoeal illness in a circumscribed area of Bristol; 62 cases were confirmed as due to *G lamblia*. The geographical location of the cases matched the local water supply

distribution, and a case-control study strongly suggested that the outbreak was waterborne. Furthermore, there had been repairs on the water main to the affected area shortly before the outbreak, indicating a possible mode of contamination, although no link with wild animals was found.

Lassa fever A 27-year-old British nurse, working in Sierra Leone, became ill in February 1985. Her clinical condition deteriorated and the diagnosis of Lassa fever was confirmed by the isolation of virus from blood and urine at the PHLS Centre for Applied Microbiology and Research. She was repatriated by the Royal Air Force on 8 March, flying under isolation in a VC10 from Freetown, Sierra Leone to Bristol, where she was admitted to the high security infectious disease unit at Ham Green Hospital. She made a slow recovery and was eventually discharged in the middle of May.

This was the tenth reported case of Lassa fever imported into the UK and the first to be transported to the UK in an isolator. All the other nine cases are believed to have travelled on scheduled air flights, four of them while they were ill, two in the incubation period and three during convalescence. Eight of these cases recovered and one died. No spread of infection was reported.

Cholera On 1 June 1985 a baby aged two months arrived in the UK from Pakistan. She had had diarrhoea for about 10 days and when admitted to hospital in Bradford, *Vibrio cholerae* 01 was isolated from her stools. She died on 9 June. All her contacts remained well and there was no spread of infection.

The pandemics of classical cholera in the 19th century gave rise to widespread outbreaks of the disease in the UK but the disease disappeared from the country early in the present century. Cholera, due to the El Tor biotype of *V cholerae*, appeared again in 1970 but with almost no spread of infection. There have been 44 reported cases and 5 symptomless excretors with 2 deaths. Most of the infections were acquired in Asia. There was only one infection acquired in the UK—the wife of a case, who nursed him at home and was shown to be a symptomless excretor.

Archaeological smallpox An archaeological excavation of a church crypt in East London in April 1985 uncovered human remains with lesions around the knee suggestive of smallpox. Excavation of the crypt had begun in November and because the person interred died during a period (the 18th and early 19th centuries) when smallpox was prevalent in London, special instructions had been given to archaeologists to report any suspicious findings to the Health and Safety Executive.

The last case of naturally acquired smallpox in the world was in Merka, Somalia in October 1977. Many crypts and burial grounds have been excavated since that date, both in the UK and elsewhere in the world, without special precautions against the risk of smallpox infection. It was

not clear why this East London crypt was thought to pose a particular risk, although the cool and dry conditions in the crypt might favour the survival of variola virus for a longer period than would damper and warmer places. However, it hardly seemed credible that the virus might have survived here for nearly 150 years (the last interment was in 1858) and yet not have survived elsewhere in the world and become apparent by localized outbreaks of smallpox. Despite this, expert opinion was divided. Virus had been shown to survive at least 13 years and some authorities considered it prudent to offer vaccination to those excavating crypts. Others did not accept this view and believed that it was unjustified to expose these individuals to the small risk of a complication of vaccination.

The dilemma was resolved by a decision to accept the variola virus could have survived in this crypt. Consequently, the archaeologists were vaccinated and placed under surveillance, preliminary arrangements made for admission to hospital if required, and samples of the suspected smallpox lesions were taken by vaccinated medical staff wearing full protective clothing and respirators. In the event none of the 'contacts' became ill, and there were no adverse reactions to vaccination. The samples from the crypt, examined at the Centers for Disease Control in Atlanta, contained brick-shaped particles, although whether these were variola virus could not be substantiated. But if they were, clearly the virus was as dead as its victim.

Dr NS Galbraith

Centre for Applied Microbiology and Research—Porton Down

The PHLS Centre for Applied Microbiology and Research (CAMR) is primarily a research and development centre in microbiology and biotechnology. It also has a range of activities serving the interests of public health in relation to communicable disease, plus a variety of products and processes which are sold commercially. CAMR is developing with the intention of maximising its income, in particular through the agreements made in 1986/86 with Porton Products Ltd (described below) and through research and development in association with other organisations.

The agreements with Porton Products Ltd

The start of the seventh year of the CAMR's life as part of the PHLS began with the Distributorship and Marketing Agreement between the PHLS Board and Porton Products Ltd (PP), taking effect from 1 April 1985. Under the agreement PP provide the commercial arm for marketing the results of CAMR's research and development. This Agreement, which was approved by Ministers, was negotiated specifically to recognise and protect CAMR's wider PHLS role, as well as to develop its commercial potential. In outline, the arrangements are that PP will market and distribute products and processes originating from the CAMR, by purchasing from us at full cost and paying royalties on sales.

In spite of the care taken to explain the true nature of the new relationship created between CAMR and PP—including a Parliamentary Question and a press release—it has become apparent that there are considerable misunderstandings at large about the arrangements. CAMR remains able to assist this country's industry by collaborative work with UK firms, providing these do not result in a direct clash of interest with CAMR/PP activities. This is well illustrated by the funding for the Centre from the Department of Trade and Industry (DTI) as part of the Government's Initiative in Biotechnology, which established several such joint projects. (It is significant that DTI welcomed the signing of the Agreement between PHLS and PP.) It is intended to apply for further support for joint ventures in novel areas of biotechnology.

Prior to the signing of the Agreement, PP undertook to negotiate another Agreement for the funding and construction of a new fermentation pilot plant (FPP) at CAMR. The need to replace the existing FPP had been recognised by the PHLS when CAMR was taken over in 1979, because the present building and its equipment had reached the end of its working life. How to find the money for the new FPP had been a major concern for the PHLS Board, and the signing of this Agreement relating to the FPP, in June 1985, ended this undertainty. The rest of the year was then occupied by a review of the planning for the new facility, including

discussions with regulatory bodies, at home and abroad, concerned with medicinal substances.

Much work lies ahead for both parties to ensure that the maximum advantage is taken of the commercial possibilities opened up by these two Agreements, which together constitute the most important and significant development in CAMR's history since the PHLS took over in 1979.

Human growth hormone

Another important event during the year was the withdrawal of the use of pituitary extracted human growth hormone (hGH) by DHSS in May 1985. Until recently the only source of hGH for the treatment of pituitary dwarfism came from human pituitary glands removed at autopsy. (Unlike insulins, animal growth hormones are not effective in man.) Shortly after the PHLS took over CAMR, the task of extracting hGH was transferred from MRC laboratories at Cambridge to CAMR. Considerable trouble was taken to create appropriate facilities for this work and to defining a process with maximum protection not only for the end product, but also for the staff involved. Regular production of hGH for clinical use became an important routine function and source of income for CAMR.

In early 1985 it was reported from the USA that three patients in that country who had been treated with (American) pituitary extracted hGH in the 1960s and 1970s had died, one from histologically confirmed Creutzfeld-Jakob disease (CJD) the other two from neurological illnesses resembling CJD. This brain disease is caused by a 'slow' virus (there is controversy about the exact nature of the infective agent) and it was thought possible that contagion might have occurred via the hGH injections, and therefore the FDA decided to withdraw pituitary hGH from clinical use. A similar decision by the Committee on Safety of Medicines followed in Britain.

In a written statement (9 May 1985), the UK Health Services Human Growth Hormone Committee stressed that the facility at CAMR for hGH extraction was the best in the world, and that the UK was the only country to have tested its hGH preparation for 'slow' virus contamination, with negative results. Whilst the Committee believed that the CAMR product was the least likely to be contaminated of any pituitary hGH preparation then currently available, nevertheless they could not give patients an absolute assurance that the product was not contaminated (in part because of the unusual resistance of these agents to inactivation). This, coupled with the belief that biosynthetic hGH (genetically engineered and not subject to CJD contamination) would become available within 12 months, led to the decision to withdraw the natural product from clinical use.

CAMR then undertook a limited amount of work to prepare extra hGH, plus other pituitary hormones, to act as biological standards against which to evaluate the biosynthetic hormones. A decision is awaited on the future of the national collection of human pituitary glands (some tens of thousands), now that the principal reason for their storage has ceased.

1985/86 at CAMR

The year has also been notable for the start of Value-for-Money Reviews (VFMs) of all the constituent Laboratories (Departments) at CAMR. These Service-wide reviews were initiated by the PHLS Board at CPHL, and provide a means of evaluating the worth of the work currently undertaken throughout the PHLS. At CAMR the VFMs have proved to be the stimulus to provide clearer terms of reference for the role of the Centre, and have already led to the realisation that different parts of the institution fulfil various functions, be these in relation to the principal task of the PHLS in controlling communicable disease, to developments in biotechnology, or to the generation of income.

The past year has also brought to light considerable problems over the newly completed Production Centre, which became apparent during the commissioning period. Outside consultants in pharmaceutical design have been brought in by the Board, and a programme of remedial work identified to rectify faults, which will allow the building to be recommissioned and operational in 1987.

The Henderson Memorial Lecture for 1985 was delivered by Dr Cesar Milstein, FRS on 3 May. This annual event is the highlight of CAMR's academic programme for the year, and commemorates the first Director of the then Microbiological Research Establishment, the virtual creator of the institute. It is held as close as can be arranged to 1 April—the anniversary of the day in 1979 when the PHLS took over the management of the Centre from the Ministry of Defence. It was an honour to have attracted the current Nobel Laureate for this event, which packed the CAMR Lecture Theatre.

Special Pathogens Reference Laboratory

Specimens were received throughout the year for the diagnosis of suspected viral haemorrhagic fevers (especially Lassa), rickettsias and Q-fever. Interestingly, over 600 requests were also received for Hantavirus isolation or serology, an indication of the growing recognition of the role of this virus, now known to be indigenous in the UK, as a human pathogen. A reference facility is now available for screening rodent colonies, hybridoma cell lines and products having diagnostic and therapeutic potentials.

Research The molecular cloning of the Lassa viral genome has continued, and vaccinia virus recombinants constructed which cause the synthesis of Lassa protein in infected cells. A special DHSS-funded project on the inactivation of viral haemorrhagic fever viruses by beta-propiolactone (BPL) was completed; blood treated with BPL can be used safely for haematological, serological or biochemical investigations.

Hantavirus research has concentrated on the production of monoclonal antibodies for diagnosis, and on epidemiological studies of the transmission of the virus within rodent colonies.

Production At the joint request of the DHSS and Wellcome Diagnostics, the Laboratory has been successfully growing the AIDS virus (HIV) in bulk to produce the large amounts of viral antigen needed for the Wellcome diagnostic kit. This kit performed well in the PHLS trials evaluating the commercially available methods of detecting antibodies to HIV in serum. Not only did the staff define and transfer the process from an outside research centre, but also developed and improved the process to increase the yield of viral antigen tenfold.

Vaccine Research and Production Laboratory

The Laboratory's work lies mainly in the development gap between academic research and industrial exploitation. In addition to the unit's own substantial research programme, there are many collaborations with universities and industry. Limited amounts of vaccines and other products are produced in their final form; this capability will be substantially increased once the new Production Centre becomes operational. There is much work in hand on fermenter development, funded by Department of Trade and Industry (DTI); DTI funding also supports the increasingly successful animal cell culture collection, now renamed the European Collection for Animal Cell Cultures (ECACC).

Pertussis vaccine *Bordetella pertussis* components to constitute an acellular vaccine have been identified, purified and evaluated prior to clinical trial. Some 8,000 doses of the vaccine have been produced in readiness for the Phase I and II clinical trials.

Anthrax vaccine This has been produced for the DHSS since 1963, some 10,000 doses this year. Research on an improved vaccine continues, including studies on antitoxin production in response to immunisation. Novel enrichment media are under development to improve isolation and detection of the organism.

Herpes simplex virus (HSV) vaccine There has been considerable effort on scaling up HSV growth to produce sufficient material for clinical trials both in the UK and the USA. Such trials are urgently needed to provide objective data on the efficacy of the vaccine, in view of the promising subjective results obtained on a named-patient basis. Research into HSV cell receptors, synthetic HSV peptides and the complex immunological response to HSV vaccine, has been pursued throughout the year.

Botulinum toxins and toxoids There is considerable interest in the use of botulinum toxins for eye disorders (eg squint) and other diseases of skeletal muscle. A product licence application is in hand. Diagnostic assays for the toxins have been developed and are ready for commercial use as kits. Toxoids have been produced for types A, B, C, E and F, and

also assessed as satisfactory immunogens. The biological mechanisms underlying the toxic action are under study.

Tick-borne encephalitis virus No vaccine or viral concentrates for vaccine production were made this year. Research into the molecular biology of this flavivirus continued, including the glycoproteins and studies on antigenic variation.

Pseudomonas vaccine Vaccine produced at CAMR last year, and sold to a commercial company, is now under test in human volunteers; the trial results are awaited.

Enterotoxins Large scale production and purification of *Clostridium perfringens* and *Staphylococcus aureus* enterotoxins have been perfected and assays developed. These are now ready for exploitation as commercial kits.

Kveim antigen During the year 14,000 doses of this diagnostic agent for sarcoidosis were produced, continuing work first started in 1980.

The European Collection of Animal Cell Cultures The Collection was opened in October 1984. It has now received 75 patent deposits, plus several thousand safe deposits, for both of which fees are charged. In addition, characterisation and quality control procedures on cell cultures are done for CAMR Laboratories and external customers.

Fermenter design A 150-litre polymodal (ie for either animal or bacterial cells) fermenter with full containment for pathogens has been designed and is to be delivered to CAMR soon. This DTI supported project will result in equipment for the Production Centre where it will greatly increase the scale and scope of production, and a saleable fermenter design for the British industrial company with whom the work has been carried out.

Bacterial Metabolism Research Laboratory

This Laboratory's remit is to study the role of bacteria in chronic disease, or in diseases with a long latency. In July 1985 staff numbers increased through the transfer of seven scientific staff from the Pathogenic Microbes Research Laboratory, when the latter ceased to exist on the retirement of its Director. The dental group, included among the seven transferred, has revised its scientific programmes with a switch in emphasis to periodontal disease. A new project in collaboration with the MRC Dental Research Unit has been initiated to study the bacteriology of periodontal pockets; work on the virulence factors in *Bacteroides gingivalis* has continued, and the chemostat model of dental plaque (MRC supported) will be used to study environmental conditions associated with periodontal disease.

The two large Cancer Research Campaign (CRC) grants have been renewed for a further 3 years. On the main grant, a large study has been initiated to evaluate faecal steroid analysis, in conjunction with other tests, in the early diagnosis of colorectal cancer9 The smaller CRC grant has allowed the follow-up of the large epidemiological study of gastric surgery patients, to determine the role of N-nitroso compounds in the excess cancer risk experienced by this group.

A grant from the German MRC (through Milupa AG), to study the effect on infant intestinal flora of supplements of iron, or iron binding proteins to bottle feeds, has been renewed for a further 2 years. New contracts with MAFF have been secured—one to study nitrate pharmacology and dietary nitrate in various populations for 3 years, another to examine bacterial N-nitrosation.

At the close of the year it proved possible to replace the old mass spectrometer, purchased in 1973 and by now virtually obsolete, with a new Kratos MS80 RFA. The Laboratory is now able to offer a mass spectrometry service to CAMR and the rest of the PHLS.

Experimental Pathology Laboratory

The major scientific projects in this Laboratory are on Legionnaires' disease. The first is an investigation into the role of extracellular proteases of *L pneumophila* in the causation of lung damage. Six proteases have been identified and separated. One of these induces experimental pulmonary lesions, very similar to those found at autopsy in man. This protease has a molecular weight of approximately 42,000, precipitates casein and degrades gelatin and collagen, but has no effect on elastin. The application of antibody against this enzyme in prophylaxis and therapy of the experimental disease is now being investigated.

The second is on antibiotic therapy, and the most significant finding has been that the application of antimicrobials by inhalation is extremely effective. As with parenteral therapy, rifampicin is the most successful drug, followed by ciprofloxacin and erythromycin. Antimicrobials given as small particles (5 μm) in an aerosol reach high lung levels almost immediately, suggesting that this type of therapy should be instituted at an early stage of the disease clinically, in conjunction with parenteral treatment.

Third, work has been done to induce immunity to *L pneumophila*. A promising degree of protection has been achieved with purified lipopolysaccharide in incomplete Freund's adjuvant, and further work is aimed at analysing the mechanisms involved.

The Laboratory is also involved in the CAMR acellular pertussis vaccine project, concentrating on the immunology. In collaboration with clinical centres and staff of the Division of Epidemiology at CPHL, studies have been undertaken of the childhood serum and secretory antibody responses to pertussis antigens. Immunoglobulin class-specific ELISAs are used to measure responses to pertussis vaccination and infection. This methodology, and the baseline data obtained, will be

applied in forthcoming clinical trials of acellular pertussis vaccines.

Finally, the role of flagella in the pathogenesis of *Campylobacter jejuni* infections has been established, and the potential of flagella as a vaccine candidate is under investigation. Outer membrane proteins and surface antigens of *C pyloridis* have been identified, and purified antigens are being isolated for use in the diagnosis of the infection.

Microbial Technology Laboratory

This is the largest Laboratory at CAMR, and includes the existing Fermentation Pilot Plant (FPP). In addition to a substantial research and development programme, there is also a heavy production schedule at the FPP. Not only are the fermentation runs and initial extractions of asparaginase done there, but diagnostic enzymes, cell pastes and other substances are also produced. A substantial proportion of the DTI funding of CAMR goes to this Laboratory, including support for the Biosensors Group, whose work is aimed at the development of new control devices for bioreactors. The work of the Laboratory includes a wide range of projects.

There has been a steady increase in demand for *Erwinia* asparaginase, in part due to its improved survival results in children with acute lymphoblastic leukaemia. The efficiency of extraction has been improved by over 10 per cent.

Under a new Agreement with Porton Products Ltd, genetically engineered *E coli* synthesising human growth hormone is being fermented for Kabi-Vitrum, as part of their process for producing methionyl human growth hormone. In the early 1980s CAMR had assisted Kabi-Vitrum to scale up the original genetically engineered *E coli* developed by Genentech. Protein A production has been scaled-up with the fermentation of an *E coli* clone synthesising this commercially important protein. The high levels of production achieved have enabled Porton International (acting through their company Porton Products) to be the first in the market with 'recombinant Protein A'. Porton Products are also marketing Streptavidin, taking full commercial advantage of improvements in production procedures which have given a three-fold increase in yield. This product is now being sold as an important diagnostic reagent, with many areas of application.

The Laboratory has been working for a number of years, with Department of the Environment support, on the biodegradation of certain important environmental pollutants. A general dehalogenation process, using a mixed anaerobic population of *Clostridia*, has been effective against dieldrin and lindane.

Work on developing systems based on high pressure liquid chromatography (HPLC) for the rapid isolation of proteins by dye and immunoaffinity chromatography has continued. One part of this programme has developed methods for the purification of synthetic oligonucleotides.

This separation technique has successfully purified synthetic oligonucleotides up to 27 bases long.

The Diagnostic Enzymology Group has now developed a diagnostic kit for salicylate assay, again marketed by Porton Products. The paracetamol kit previously designed by this Group continues to sell well, and an automated version is now sold by Porton Products, in addition to the manual version of the kit already licensed to Cambridge Life Sciences Ltd. A number of other assays are currently in an advanced state of development, and more kits should appear on the market over the next 12 months.

The small scale fermentation laboratory, established with DTI funding, has been increasingly automated. The experience gained has been put to use on a larger scale in the FPP, and foreshadows the advanced degree of computer monitoring and control which will feature in the new FPP to be built at CAMR.

The DTI-funded Biosensors Group has established acoustic resonance densitometry as a technique for commercial (large scale) biomass monitoring in fermentation control, along with other techniques. The group has also shown that lasers, linked with fibre optics and particle analysis, have a wide potential for assay of proteins and other macromolecules in solution. These techniques hold the possibility of wide applications, eg in immunoassays, process control monitoring and microbial detection.

Therapeutic Products Laboratory

The work of this Laboratory had been concentrated on two therapeutic products—*Erwinia* asparaginase (an accepted part of the standard treatment of acute lymphoblastic leukaemia) and pituitary extracted human growth hormone (hGH) for correcting pituitary dwarfism in children.

Asparaginase The partially purified enzyme is received from the FPP and then processed in this Laboratory's licensed clean rooms. During the year 780 megaunits were manufactured to various stages of completion, with 483 as finished vials; 123 megaunits were issued to UK hospitals and 290 to overseas. The improved results of treatment with the *Erwinia* asparaginase, compared to other therapeutic regimens, were established by recent MRC trials, especially UKALL Trial VIII (subsequently published in *The Lancet*, 1986, **i**, 408).

Human growth hormone The withdrawal of pituitary hGH from therapeutic use, and the end of collecting pituitary glands at autopsy, led to a rapid run-down of hGH production at a time when yields of the hormone had reached high and consistent levels, thereby overcoming the national shortage. The Laboratory programme in this field was then concentrated on managing the stocks of previously collected glands (the National Collection) as well as the bulked by-products of hGH extraction (rich in other pituitary hormones, especially the gonadotrophins FSH and LH) and the unused vials of hGH returned from clinicians. Work was then put into developing methods for preparing highly purified hGH to

serve as a Standard against which hGH from recombinant DNA will be assessed; other hypophyseal hormones are being dealt with in the same way.

Freeze-drying During the year this Section filled and freeze-dried 10 different products into a total of some 53,000 vials in the course of production runs; 21 requests for other freeze-drying services were dealt with.

Production centre In spite of the problems with this new building, it proved possible to make some use of the clean room laundry; the sterilising oven and autoclaves and the vials inspection room were also in use. The new freeze-drying unit in the building was operated for a non-clinical product.

Molecular Genetics Laboratory

The major theme of this Laboratory continues to be the development and application of genetic manipulation to health associated problems.

HIV The CRC supported link between the Laboratory and Africa has continued. Work on the seroepidemiology of the AIDS virus in south west Uganda has shown that the overall incidence of the disease (known locally as *slim*, because of the marked wasting) is now estimated at 0.3 per cent. Studies on Ugandan women of child-bearing age indicated that some 16 per cent are infected with the virus. The major advance in the Laboratory research programme on HIV has been the development of a procedure for routine isolation of retroviruses from the white cells of patients with clinical AIDS or Kaposi's sarcoma. Some 30 different viral isolates have now been obtained, and five of these established in a continuous cell line. This enables high levels of cell-free virus to be obtained relatively easily, giving rise to the possibility of a diagnostic kit based on these isolates.

Human cytomegalovirus (HCMV) There are a number of research projects being undertaken on this virus, with strong grant support from MRC. The most significant process is related to the development of a versatile eukaryotic expression vector. This has been used to express a number of viral genes in tissue culture cells. An HCMV gene thought to be analogous to the HSV-1 gB gene has also been expressed in low levels in *E coli*. Work on the isolation and characterisation of HCMV glycoproteins has been extended by the identification of high molecular weight complexes within mature virions. The isolation of these complexes will facilitate studies on the importance of conformational or assembled epitopes in determining the immune response to HCMV infection.

Whooping cough Work has continued on the difficult problem of cloning the *Bordetella pertussis* protective antigens, and has centred on the

isolation of transposon insertion mutants defective in the production of the relevant gene products.

Quality control and Safety Laboratory

This Laboratory was formed in mid-1985, bringing together the management of the safety, quality assurance and quality control functions of CAMR.

Quality assurance and quality control CAMR manufactures several important therapeutic, diagnostic and prophylactic pharmaceutical products which include asparaginase, human growth hormone (withdrawn in May 1985), Kveim antigen and viral and bacterial vaccines. Other products are under active development, and will either be the subject of clinical trials, or of Product Licence applications. The quality control (QC) functions to support these production activities include the development and management of good manufacturing practice, a comprehensive documentation system and close liaison with control and regulatory bodies to secure registration of the products. In order to meet these responsibilities, the Laboratory has organised QC into three sections—Microbiological QC, Regulatory Affairs and Documentation, and Analytical Services QC.

Safety This Section includes staff responsible for maintenance of safety and safety training at CAMR. In addition there are R & D projects aimed at assessing and improving formaldehyde fumigation procedures; and a long-term project on the evaluation of respiratory protective equipment in a purpose-built unit. The Section provides advice and assistance on microbiological safety to PHLS Laboratories, the NHS, industry and other organisations. This type of work includes testing equipment for compliance with the relevant safety standards.

The Laboratory is also involved with environmental studies on Legionnaires' disease, including the prevalence of the organisms in water supplies and cooling towers. Several staff members were actively engaged in the investigations into the major outbreak in Stafford in April 1985.

Table 5 Examples of CAMR workload 1985/86

Production of asparaginase
483 megaunits as finished vials
123 megaunits issued to UK hospitals
290 megaunits issued to overseas hospitals
(Remainder to stock)

Production of vaccines

Anthrax vaccine	10,000 doses
Acellular pertussis vaccine	8,000 doses
Herpes simplex vaccine	1,000 doses

Production of Kveim antigen
14,000 doses

Production of tissue cells
MRC-5 cells 2×10^8 per week
(Primary kidney cells 2×10^9 per week)

Large-scale cultures and extractions	**Cultures**	**Extractions**
Human growth hormone	9	—
Asparaginase	75	31
Aryl acyl amidase	2	—
Carboxypeptidase G_2	7	2
Glycerokinase	7	—
Staphylococcal nuclease	4	—
Streptavidin	4	4
Others	25	1

Specimens examined	**Numbers examined**
Viral haemorrhagic fevers 1	177
Arboviruses	558
Rickettsias	438
Q-fever	78
Hantavirus	639

Dr PM Sutton

Special topics 1985/86

CPHL's official opening

Behind this inscription on a simple piece of Welsh slate in the front hall of New Colindale lie several months of planning, many weeks of hard work and one day of celebration. Still further back, of course, lie years of frustration, hope and effort culminating in four years of building. Planning for the opening really started with a Board minute of 28 April 1983 setting up an advisory committee. To help, the secretary produced a long list of 'matters requiring consideration' and 'advice on procedure' laid down by the Ministry of Health in 1962. It was an easy and unanimous decision to invite the Queen, but royal programmes being what they are we did not know she had accepted until July 1985.

After that the pace quickened as coordinated planning took over with increasing speed and complexity. Who should be invited, or worse, who should not, where might the Queen wish to visit, what should we demonstrate and where, would the Royal party get lost (we still did) what about the press, and protocol, had we forgotten anyone, what should you say, should you say anything, protocol again, was the china good enough, was it even china, had we forgotten anything, what about the *Times*? Then thankfully arrived the *deus ex machina*, the Private Secretary, Sir

Phillip (now Lord) Moore who, with great experience, wisdom and charm, made it all seem very clear and simple.

The Queen in scarlet and black was received by the Mayor of Barnet, Mrs Barbara Langstone; the MP for Hendon North, Mr John Gorst; and the Under Secretary of State for Health, Baroness Trumpington. Apparently in London it is not the normal practice to include on these occasions the Lord Lieutenant of the County. Once in the lecture theatre the Queen was welcomed by the Chairman of the Board and presented with a bouquet and a copy of Sir Robert Williams' history of the PHLS. She then unveiled the plaque and the building was officially open. The bouquet was based on the plants used in 17th century nosegays to ward off pestilences, though we trusted its use would now be purely symbolic. It proved difficult to get feverfew, wormwood and other prophylactic herbs in December, but the authorities at Kew were most helpful and a muddy CPHL driver returned with a forest of greenery.

The tour of the building and the laboratory demonstrations showed the Queen to be both informed and interested, so that the staff were kept busy dealing with a series of pertinent questions, comments and asides. (The habit of exposing young sisters to brothers with rubella is not confined to commoners, but apparently the stratagem did not work.)

After signing the visitors' book and a portrait of herself the Queen at her express wish took tea with 50 members of staff and chatted to them all.

Then, well after the prescribed time, she left. As a worldly wise journalist, much impressed, commented 'The Queen must have enjoyed it; if bored Her Majesty doesn't hang around'. So ended a day which marked the culmination of years of endeavour. It was made successful by the great efforts of everyone at Colindale who put so much into planning and execution, and by the friendly atmosphere conveyed so readily by the Queen and her party; I thank them all. But let us also remember all those whose work over 20 years made New Colindale a reality.

Professor AA Glynn

The PHLS response to AIDS

The previous report described the PHLS response from the time, December 1982, of the first report in the UK of a patient with AIDS. 1985/86 just passed has seen a consolidation and extension of that response. The basic monitoring and surveillance carried out by CDSC continues. The PHLS *Communicable Disease Report (CDR)* of 29 March 1984 recorded 140 UK patients with AIDS, of whom 61 were dead. In the *CDR* of 28 March 1985, the corresponding figures were 328 and 167. Reporting of patients with antibody to the human immunodeficiency virus (HIV) was started in March 1985 and over 2,500 reports were received. This is a serious underestimate, both because testing facilities were very limited for most of the year and because there must be many seropositive individuals who have not come forward for testing.

The major achievement of the year was the establishment of antibody testing facilities in some 30 PHLS laboratories so that anyone who wished could, through their doctor or a clinic, find out their antibody status without going to a blood transfusion centre. Six laboratories also undertook to do confirmatory tests on positive sera or where the results were questionable. The test facilities were made available from October 1985, to coincide with the introduction of antibody screening of blood donors by the Blood Transfusion Service (BTS). Testing on this scale was made possible by the availability of commercial kits, although the expertise already gained by several laboratories who had set up their own systems was extremely valuable in getting the whole programme going quickly and smoothly. Much onerous and responsible work was done by the AIDS laboratory at CPHL in formally assessing the kits available and in training people in their use. It is gratifying that CAMR has successfully overcome the problems of large-scale growth of HIV and was able to satisfy the demands of Wellcome for what proved to be a popular, reliable kit. The Division of Microbiological Reagents and Quality Control at CPHL was able to provide working standards and panels of sera for reference to all PHLS, BTS and NHS laboratories requiring them. There are considerable difficulties in obtaining, calibrating and distributing such sera, but DMRQC's effort has made it much easier for laboratories to maintain a consistently high standard of testing.

The advent of readily available tests for HIV antibody has increased the laboratory workload both directly and by the incentive to many laboratories to undertake investigation into methods or to carry out local surveys. It has also raised ethical and administrative problems, for example where tests are required for reasons other than to help diagnose the patient concerned, or where they are requested urgently out of normal working hours for organ donors. The professional advice of medical microbiologists upon questions related to HIV infection is in growing demand.

Widespread antibody testing transformed the epidemiology scene by making it possible to follow infection rather than clinical manifestations, which may take years to appear. However, the increased load on the monitoring group at CDSC made it increasingly difficult, for example, to follow up all HIV antibody positive people who did not fall into a currently recognised high risk category. The study of health care workers continued, though fortunately with little in the way of positive results. The sexual practices of homosexual men were studied in relation to their serological status. It is of prime importance to detect as early as possible the inevitable spread of HIV infection beyond the present risk groups. To this end the study of HIV infection among heterosexuals attended Sexually Transmitted Disease Clinics continued and is being expanded. Several laboratories were engaged in joint studies with Haemophilia Centres.

Professor AA Glynn

Cook-chill catering

PHLS area and regional laboratories and the Food Hygiene Laboratory at Colindale have recently given much attention to cook-chill catering systems. These are based on the fast chilling of cooked foods and subsequent storage at temperatures of 0° to 3°. Such food is then reheated immediately before consumption. In the late 1970s a DHSS Working Party was set up to produce official guidelines suitable for use by caterers who wished to embark on cook-chill catering operations using the new chilling equipment that had been marketed in the UK. Consideration had to be given to the quality and palatability of the end product, including the nutritional and flavour effects of chilling food, but the principle objective was to ensure the safety of the food and the prevention of food poisoning. The PHLS were much involved in the activities of the Working Party, and several PHLS laboratories co-operated in the microbiological investigation of various pilot schemes. The results of these studies were the basis of several of the recommendations in the DHSS Guidelines on Precooked Chilled Foods published in 1980.

Experience gained during the last six years indicates that the safe operation of the systems depends upon careful planning, regular inspection, training and supervision of staff, and detailed attention to rapid cooling and temperature control. More than 500 cook-chill systems are now in daily use in hospital, institutional and industrial kitchens. Many more are being built and, with the aim of preventing food poisoning, PHLS laboratories have become much involved in the planning of these new systems and in the application of the microbiological guidelines included in the DHSS document. Experience gained from cook-chill systems examined to date indicate that microbiological tests are of particular use in the initial commissioning period. Once satisfactory microbiological levels are achieved, the frequency of sampling can be greatly reduced. Microbiological guidance in the planning and commissioning stages of individual systems, although time-consuming, has proved of great value in permitting the safe introduction of cook-chill catering.

Dr RJ Gilbert

Vaccine surveillance

Vaccines are invaluable in the control of infection, but they require careful study and attention. Not only do new vaccines have to be subjected to trials of efficacy and safety, but existing vaccines and the corresponding diseases must also be kept under surveillance. Microbes are liable to undergo antigenic changes which may allow them to break through vaccine-induced immunity, and vaccines themselves may, during manufacture, develop subtle changes which alter the efficacy or safety of the product. Such changes may be detected only by surveillance. The side-effects of drugs, including vaccines, are of growing medical and

public concern which, in the case of vaccines, is liable to become greater as the corresponding diseases come under control. PHLS resources for surveillance of vaccines are severely limited, and are heavily dependent upon collaboration and support from health authorities. Two recent findings are of particular note.

Rubella The studies referred to in last year's Annual Report indicated that the present UK rubella vaccination policy is most unlikely to eliminate congenital rubella syndrome completely from the country. For example, despite an intensive and very successful vaccination programme for teenage girls and adult women in Manchester, a core of unvaccinated non-immune women remains. Among this group some inevitably become infected in pregnancy, because the virus remains in wide circulation in young children. Such observations have stimulated a reconsideration, still in progress, of the advisability of adding to the present vaccination programme the immunisation of boys and girls in infancy (with combined measles/rubella or measles/mumps/rubella vaccine), which would undoubtedly be more effective—providing a high vaccine acceptance rate can be maintained.

Poliomyelitis There was an outbreak of poliomyelitis due to type 3 virus in 1984–85 in Finland, where inactivated vaccine given by injection is used. Some six of the nine cases identified had been fully immunised. Careful investigation revealed that the vaccine in use in Finland was poorly immunogenic in children, and also that the infecting type 3 virus exhibited a degree of antigenic change from the prototype virus present in the vaccine. Studies were immediately instituted in collaboration with the National Institute for Biological Standards and Control, to establish whether or not a similar risk might be present in the UK, where live oral vaccine is used. Serum samples showed satisfactory levels of type 3 antibodies, which were capable of neutralising the new strains of virus. No strains showing antigenic changes have been detected in the UK. It therefore appears that we are not at risk in the UK, but surveillance must continue in view of this newly-recognised capacity of the poliovirus to undergo antigenic change.

Automation and computing

The PHLS maintains a strong interest, including relevant research and development, in the application of automated and mechanised methods. Although automation has had a profound effect on clinical biochemistry, its place in microbiology has so far been relatively small, for a number of reasons: microbes have to be grown and skilfully manipulated in order to isolate them in pure culture before they can be identified; there is the need for precautions in the handling of usually infectious specimens; and the fact that much of microbiology consists not of a simple estimation of the concentration of an analyte, but of a deductive process requiring a

sequential series of judgements, for example, of which microbes in a mixed flora to isolate, which tests to carry out, and to decide how the results should be applied to a particular specimen from a particular patient. Nevertheless, there have been many useful applications of automation, notably in blood culture methods, serology, antimicrobial assay and the use of multi-point techniques for identification and antimicrobial sensitivity testing.

Computing is, of course, widely used in the PHLS, notably at CPHL, CDSC and Headquarters, for epidemiological data recording and analysis, financial control, analysis of workload and for research. But developments in diagnostic laboratories—for the creation of specimen files, recording results, preparing reports and for analysis of local epidemiological data—have been largely determined by local initiative. Many laboratories have developed microcomputer systems to record information about subjects of special interest or significance, eg rubella screening or cases of hepatitis. In addition, five laboratories are using MICROLAB—the microbiology software developed jointly by PHLS and Information Technology Limited. Commercial companies including ITL and Ferranti are now developing software packages to meet the needs of all pathology disciplines including microbiology. The development of these multi-disciplinary systems is supported by regional and district needs for management information—needs which the PHLS regional and area laboratories must take into account. Future investment in computing by the PHLS will be based upon an agreed information policy, and development of such a policy had been initiated by the end of the year 1985/86.

Epidemiology in the North-west Region

An epidemiology information service has been operated from the Public Health Laboratory, Manchester for about eight years. The Region has a population of approximately 3.9 million, divided into the largely urban Greater Manchester and the mixed urban and rural Lancashire. It has 18 District Health Authorities, and microbiology services are provided by 25 bacteriology and 3 virus laboratories. The information service, particularly appreciated by MOsEH and EHOs, supplements that of the PHLS *Communicable Disease Report (CDR)*, and provides a picture of the trends in infection and communicable diseases within the region.

The service receives data on a weekly basis from two sources. First, local authorities send duplicate copies of their returns to the Office of Population Censuses and Surveys (OPCS) on statutorily notifiable diseases. Second, laboratories report weekly on new cases of selected infections, mainly those acquired in the community or that may cause local outbreaks. Bacteriology reporting is done using a standard reporting form and provides relevant clinical and epidemiological information, such as foreign travel in the case of enteric infection. Virology data is provided by copies of the weekly *CDR* reporting forms.

For the last four years all data has been stored on micro-computers. Certain key information is coded to enable easy analysis; for instance, all cases with a history of foreign travel, and all cases which are part of a discrete outbreak, are given common codes.

Each week a report is produced which is distributed within the region to all microbiology laboratories, MOsEH, Environmental Health Departments and other interested groups such as genito-urinary physicians. The front page of the report has a *this week* section which gives details of new outbreaks or unusual or important cases, eg new enteric fever cases. It also has an editorial section, the contents of which vary from an analysis of regional data on a particular organism such as pertussis, to a discussion of a topic of general interest such as prevention of salmonellosis or immunisation against influenza. The middle pages of the report contain details of infections reported that week, grouped by organism. Virology data is confined to reports of unusual cases together with periodic reviews of analysed data. The data collected is of great value in monitoring trends and in detection of outbreaks. The service is in continual evolution: recently, methicillin-resistant staphylococci have been added to the reporting system and data on HIV is now being collected.

A regional service of this type may be seen as a natural adjunct to the national service provided by CDSC, acting as a valuable reference point for CDSC within the region for exchange of information, particularly about national outbreaks such as the *Salmonella ealing* incident (see page 63). Several community outbreaks have been detected earlier by this means than would otherwise have been possible. *Salmonella bovis-morbificans* provides a recent example.

Salmonella bovis-morbificans During the week of the 6 July 1985, reports were received from five laboratories involving a total of 12 patients infected with Group C salmonellas. Several of these strains were referred to PHL Manchester for serotyping and were found to be *S bovis-morbificans*, as were all the other Group C strains subsequently reported. Until that week in 1985 only 3 cases of *S bovis-morbificans* had been reported in the Region. It was therefore immediately apparent that an outbreak was developing. As can be seen in Figure 5, the cases did not come from a single locality, so that a point source outbreak such as a restaurant seemed unlikely. A cooked product sold through retail outlets was a possible source, although there were many other possibilities.

Investigations in association with MOsEH and EHOs rapidly yielded results. Within 24 hours it emerged that all 5 cases in one district had eaten cooked meats purchased from the same market stall. Samples of cooked meats were obtained from the stall and examined by PHL Manchester; *S bovis-morbificans* was isolated from a sample of roast beef. Questionnaires distributed to the more scattered cases revealed that most of these had eaten cooked meats prior to becoming ill, in nearly all cases from the same factory. The factory was visited immediately by staff

of the Environmental Health Department and control measures were instituted. By the end of the outbreak 63 cases were identified, distributed as shown in Figure 5. Almost all of the patients had consumed cooked meats from retailers or hotels supplied by the same factory. Indeed, the distribution of cases closely mirrored the distribution of the retailers and hotels supplied by the factory.

The outbreak would have become obvious eventually, even in the absence of the local epidemiology service. But it was felt that the

Figure 5 Distribution of *S bovis-morbificans* cases during the outbreak

combination of the intra-regional reporting system and the local salmonella serotyping provided by the PHLS at Manchester and Preston resulted in the detection of the outbreak, the identification of the source, and the institution of control measures much more rapidly than would otherwise have been the case.

Dr T Riordan

Meningococcal meningitis in Gloucestershire

It is hardly surprising that meningitis excites both public and professional interest. The disease is a severe one and in recent years about 10 per cent of victims of meningococcal meningitis have died, despite treatment with antibiotics to which the organisms remain exquisitely sensitive.

Meningococci cause infections worldwide, notably in sub-Saharan Africa where the disease is highly seasonal. In the UK large outbreaks due to Group A organisms occurred during both World Wars, affecting recruits and the civilian population. Since the 1970s Group B organisms have increasingly predominated and a typing system (devised by Frasch) making use of variations in the outer membrane proteins has permitted better epidemiological differentiation. B2 organisms had previously made up the majority of Group B strains sent to the PHLS Meningococcal Reference Laboratory, but by 1985 they had been supplanted by B15 strains, the majority of which were sulphonamide resistant.

The Gloucestershire outbreak began in 1982 with the isolation of a sulphonamide-resistant Group B meningococcus from a 13-year-old schoolgirl recently returned from a trip to Bulgaria. This girl made a remarkable recovery from a severe meningo-encephalitis to return to full health. She proved to be the first of five pupils attending a single school in the village of Nailsworth near Stroud who contracted the disease over the next two years. Other cases occurred in the surrounding villages and in Gloucester City. The end of 1983 was marked by a hectic two month period with 12 cases of meningococcal infection centred on the town of Stroud itself. The years 1984 and 1985 saw continued activity and 1986 looks as if it will be the worst year yet, with 23 cases recorded up to the end of August. There is usually a lull in meningococcal disease in the third quarter of the year, so the high level of activity through the summer of this year suggests that the outbreaks will continue in the coming winter. Over the five years of the outbreak there have been 82 cases. Despite the high mortality associated with the infection we have been fortunate that only four patients have died, though a number of others have suffered permanent sequelae such as deafness or, in one case, loss of fingers due to vasculitis.

Since March 1983 the PHLS Meningococcal Reference Laboratory in Manchester has collaborated closely and has serotyped meningococci from cases and contacts. Its advice and information have proved invaluable, enabling possible links between cases to be confirmed or disproved. It has also given some epidemiological puzzles to think about.

The Gloucestershire cases have been caused principally by sulphonamide resistant B:15 Pl16 meningococci, although Group C strains have been isolated increasingly in 1985 and 1986. Most cases have been teenagers and young adults, and there have been only two infant cases. This contrasts with the national picture in which predominantly infants and young children are affected.

Community physicians and environmental health officers co-operated in taking throat swabs for culture from contacts and in wider swabbing exercises in schools with recent cases. B15 organisms were isolated remarkably infrequently from asymptomatic contacts, suggesting that these organisms are poorly transmissible yet more virulent than other meningococci when established in a new susceptible host. Close contacts have been treated with rifampicin, though with little apparent effect on the incidence of secondary cases. Although vaccines against meningococci of Groups A, C, Y and W 135 have been developed, unfortunately the Group B polysaccharide is a poor immunogen. No effective vaccine for these strains has yet been developed, despite considerable research, although promising results have been reported of an experimental B2 protein vaccine.

Gloucestershire is not the only focus of cases in the UK: Plymouth has experienced an outbreak due to the same strain of meningococcus, and the disease is also increasing in the north of England. In England and Wales as a whole an upsurge of meningococcal disease began in 1985, when there were 547 notified cases compared to 395 in 1984; the number in 1986 may prove eventually to be as high as 700–800. Nevertheless the outbreak is not so far nearly as large as the last outbreak which gave a peak of 1,296 notified cases in 1974. We need to know more about the epidemiology of B15 meningococci, and further studies of the distribution of the B15 strain and the prevalence of antibodies to it in defined populations are being made with the collaboration of CDSC, Community Physicians, Environmental Health Departments and other Public Health Laboratories. Norway and Spain have experienced prolonged outbreaks of meningococcal disease due to the B15 strain. Recent progress in vaccine development holds out hope that it may eventually become possible to prevent the disease.

Dr KAV Cartwright

Salmonella ealing in dried milk

In December 1985 the recognition that *Salmonella ealing* infection was associated with the consumption of dried milk products led to a major investigation involving the peripheral and central arms of the PHLS. This brief account of the incident illustrates the collaboration among laboratories and their different roles, and demonstrates the response on a national scale that the PHLS can generate in order to achieve a successful conclusion.

The investigation was initiated by the Division of Enteric Pathogens (DEP) at Colindale, which observed a small but significant increase in the number of *S ealing* isolates among strains submitted for identification. During the first ten months of 1985 the pattern of *S ealing* isolates had not differed from that of previous years, but during November and early December an increase was detected. A review of the data submitted with these isolates revealed that the majority of the infections were in infants less than one year old. The DHSS and Communicable Disease Surveillance Centre (CDSC) were immediately informed of this unusual age distribution, and CDSC initiated enquiries regarding the food history of affected infants through the laboratories isolating *S ealing*. It soon became clear that many of the affected infants had consumed dried milk products from a single manufacturer. The implication of these infant milk powders was confirmed by a case control study conducted by telephone and completed within 72 hours. The DHSS were informed and they arranged a meeting with the manufacturer, at which the DEP and CDSC findings were presented. The manufacturer accepted the epidemiological evidence, agreed to withdraw the dried milk products from sale and offered to participate fully in the investigation.

Following a press statement announcing the withdrawal from sale of the dried milk products, the many facets of the investigation were put in train simultaneously. A large number of PHLS laboratories undertook the examination of pockets of dried milk collected from the homes of affected infants and of samples submitted by Environmental Health Officers (EHOs) as the retail stock was withdrawn. Public Health Laboratories in the south west, the north west and the Food Hygiene Laboratory (FHL) assessed total viable counts and carried out salmonella and coliform cultures on the retention samples of all the firm's batches of infant dried milk products from 1985. EHOs of the South Lakeland District Council and staff of the Preston Public Health Laboratory with the assistance of the firm's bacteriology staff conducted microbiological investigations at the factory. Representatives from the DHSS, DEP, CDSC and FHL visited the factory and, with the wholehearted collaboration of the factory staff, carried out a full review of manufacturing practices and quality control records.

S ealing was isolated from the vacuum system used for the cleaning of the environment and plant. Having thus demonstrated the presence of the organism on the site, an intensive search for the source was carried out. Thorough examination of the plant revealed a hole (3 × cm approximately) on the inner skin of the spray drier, and *S ealing* was isolated from powder which had accumulated in the insulation material behind the hole. The examination of the quality control results suggested that certain batches of dried milk were possibly more likely to contain *S ealing*. Examination of packets of these batches had just commenced when Bath Public Health Laboratory reported the isolation of the organism in a packet from a family with two infected members. Cartons of this batch, which had been returned to the manufacturers, were examined by the

Public Health Laboratories at Leeds, Liverpool, Manchester, Preston and Sheffield and the CPHL. *S ealing* was isolated from 4 of the 260 packets cultured, indicating a very low level of contamination with the organism. Nevertheless, it constituted a serious hazard, because the young baby is highly susceptible to infections and reconstituted dried milk provides an excellent culture medium. A few hours at room temperature could result in a dangerous risk to the baby.

Following major mechanical and structural alterations to the building and affected equipment, along with massive cleaning and redecoration operations, an attempt to resume production using the same plant was made two months after the company stopped production. Despite these herculean cleaning measures a salmonella was isolated from environmental samples—though not from the product—and the manufacturer decided to remove all the offending plant.

The possibility that dried milk products may be contaminated with salmonellae has been appreciated for many years. There had not previously been any reported incident of salmonellosis following the consumption of dried milk products in the UK, but they had been reported in Australia, the USA and Trinidad. As a consequence of this incident, it is anticipated that dried milk manufacturers in this country will review their quality control procedures and introduce more stringent codes of manufacturing practice.

Dr DN Hutchinson

Education

Staff have opportunities for further education and training through external institutions on the same terms as NHS staff. But the PHLS also fosters several in-house activities, to supplement the bench training which forms part of the day-to-day work of all laboratories.

Annual Scientific Conference

The PHLS Annual Scientific Conferences serve two main purposes—to promote scientific communication within the PHLS and, by providing a forum for the presentation of results, to promote high standards of microbiology through encouraging a research approach to all aspects of PHLS work. Both purposes serve the interests of education; the first by helping staff to learn of new methods and approaches to their work, the second by encouraging the innovative approach which is a cornerstone of scientific education. The conferences also promote the personal contacts which are of such great value to the PHLS for to the efficient study and control of infection and communicable disease.

1985 saw the tenth Annual Scientific Conference. Prior to 1975, MLSOs, microbiologists and junior medical staff all had separate meetings—usually held at Colindale. In 1975 the MLSOs and microbiologists arranged a two-day joint conference at the Coventry Polytechnic. The beneficial effects of this meeting led to the establishment of further annual joint meetings, each held at a different place; in 1979 junior medical staff were also invited to attend. The change in venue each year and the increasing numbers of PHLS staff involved presented additional problems to the Organising Committee, in particular to the 'local' organiser. The availability in 1982 of King Alfred's College, Winchester as the site for future meetings eased these problems by offering on-site accommodation for up to 250 delegates and a choice of lecture theatres allowing the introduction of parallel lecture sessions. Winchester also offered easy access from both CPHL and CAMR as well as being within two or three hours of about half of the 52 peripheral laboratories. The first Winchester meeting was in September 1982, and by then all grades of staff were invited to attend.

The introduction of parallel lecture sessions, and of workshops and update sessions, has enabled a wider range of topics to be covered; this allows the inclusion of specialised areas of interest. In 1985, 73 talks were presented in the 13 lecture sessions. One lecture session is devoted to the presentation by junior MLSOs of their FIMLS work. At the end of this the JD Atkinson award is presented to the candidate obtaining the highest marks in the FIMLS examination; in 1985 it was awarded to Mrs ST Denyer of the Watford Public Health Laboratory. Up to 30 posters can be accepted for a formal poster display which complements the lecture sessions. The Trade show has more companies wishing to be represented than can be accommodated. In recent years sessions have

been included in which laboratories from CPHL and CAMR present summaries of their work.

In 1985 the final session was a talk by Sir Robert Williams on the history of the PHLS, at the end of which Sir Graham Wilson was presented with a leather-bound copy of Sir Robert's history of the service, *Microbiology for the Public Health*, in recognition of Sir Graham's 90th birthday, celebrated during the conference.

Standing conferences

Two half-day meetings, one on virological services, the other on food and environmental microbiology, are held each year. The Standing Conferences are open to senior staff for discussion of scientific and technical developments of current interest and importance to the work of the PHLS.

Invited lectures and seminars

PHLS area and regional laboratories organise talks and seminars, frequently involving community physicians and Environmental Health Officers, and there is a variety of other *ad hoc* meetings to discuss particular problems of current interest. Both CPHL and CAMR hold regular seminars given by members of staff of the different departments and by invited speakers from elsewhere. CAMR has continued the Henderson Memorial Lecture inherited from the former Microbiological Research Establishment. At its conclusion the lecture is awarded the Henderson Medal; in 1985 the recipient was the Nobel Laureate, Dr Cesar Milstein, FRS. The Wilson Lecture Theatre at CPHL Colindale is increasingly used as a venue for meetings, and the teaching laboratory at CPHL was of particular value in 1985/86 for training laboratory staff in the techniques of testing for HIV antibodies.

Mr EA Meyrick

Finance and administration

The DHSS and Welsh Office net revenue cash allocations to the Board for 1985/86 totalled £29 million. This was augmented by £7 million from the Board's various income generating activities, funding a total gross expenditure of £36 million.

The Board suffered a 1 per cent reduction in its 1985/86 basic cash allocation from the DHSS, and a shortfall in the funding of pay awards. Together, these accounted for a cash allocation reduction of approximately £0.9 million.

During 1984/85 and 1985/86 the Board instituted a series of value for money and cost reduction exercises which resulted in the identification of annual savings of £1.4 million. These reviews are being continued.

Capital schemes

The move into the new Central Public Health Laboratory complex on the Colindale site was completed by June 1985. The new building was completed at a cost of £24 million. The old site will be sold cleared to maximise its price.

Mention was made in last year's Annual Report of serious problems with the erection of the Production Centre, CAMR, which became apparent during the defects liability period. Following appraisals by independent experts, remedial works in the order of £1 million are necessary, and discussions about recovery of this sum from the contractors have commenced. Work continued on upgrading the primary services at CAMR to accommodate the increased service requirements of the Production Centre.

Other capital schemes in progress included the new joint PHLS/NHS laboratory at Dorchester and the new joint laboratory on the Singleton site at Swansea.

Personnel

The Board continued to maintain a tight control on the recruitment of staff, in order to contain expenditure within DHSS and Welsh Office cash allocations. The encouragement of voluntary premature retirement in appropriate cases continued.

The number of whole time equivalent staff employed by the Board on 31 March 1986 was 2,108; see Table 6.

Research grants

The Annual Accounts on page 122 show the sum received in the form of research grants. The main bodies from which grants were received and the amounts given are shown here in Table 7.

Table 6 PHLS staff at 31 March 1986 (in whole-time equivalents)[a]

	Regional and area laboratories	CPHL	CAMR	CDSC	HQ	Total	Totals at 31 March 1985
Consultants	88	10	1	4	3	106	104
Other Medical	37	3	1	5	—	46	48
Top Grade and Principal Microbiologists	21	32	38	2	—	92	76
Other Microbiologists	20	44	32	1	—	96	102
Technical Officers and Principal and Senior Chief MLSOs	50	14	7	—	—	71	74
Other MLSOs	728	81	98	1	—	907	874
Works	—	7	68	—	—	75	7
Nursing	—	2	1	—	—	3	2
Ancillary & Others	209	58	28	—	4	299	381
Administrative & Clerical	211	58	40	32	72	413	400
Totals	1,363	309	313	44	78	2,108	2,068

[a] These figures exclude 134 staff who are externally funded or are honorary contract holders.

Table 7 Research grants received by the PHLS in 1985/86

World Health Organisation	22,481
Medical Research Council	115,968
Cancer Research Campaign	174,160
Department of Trade and Industry	611,000
Other bodies (DHSS, DoE, MAFF etc)	693,798
Total	£1,617,407

Senior staff changes

April 1985 to March 1986

New appointments

Dr LAE Ashworth	Deputy Director, Experimental Pathology Laboratory, PHLS Centre for Applied Microbiology & Research, 1.5.85
Dr O Basarab	Director, Quality Control & Safety Laboratory, PHLS Centre for Applied Microbiology & Research, 3.6.85
Dr KE Collingham	Consultant Medical Microbiologist, Public Health Laboratory, Truro, 1.5.85
Mr PJ Hounslow	Financial Controller, PHLS Centre for Applied Microbiology & Research, 6.1.86
Dr DHM Joynson	Director, Public Health Laboratory, Swansea, 1.4.85
Dr NF Lightfoot	Director, Public Health Laboratory, Taunton, 18.8.85
Mr EA Meyrick	Assistant to the Director of the Service, 1.2.86
Dr P Norman	Deputy Director, Public Health Laboratory, Sheffield, 1.11.85
Dr JH Pennington	Director, Public Health Laboratory, Chester, 1.2.86
Dr JVS Pether	Deputy Director, Public Health Laboratory, Taunton, 18.8.85
Dr CD Ribeiro	Deputy Director, Public Health Laboratory, Cardiff, 1.5.85
Dr D Roberts	Deputy Director, Food Hygiene Laboratory, Central Public Health Laboratory, 18.7.85
Dr HG Ross	Consultant Medical Microbiologist, Public Health Laboratory, Leeds, 23.7.85
Dr MS Shafi	Deputy Director, Public Health Laboratory, Central Middlesex Hospital, 12.8.85

Dr JWG Smith	Director of the Service, 12.8.85
Dr EI Tanner	Director, Public Health Laboratory, Epsom, 14.6.85
Dr AG Taylor	Director, Division of Microbiological Reagents and Quality Control, Central Public Health Laboratory, 18.7.85
Dr EL Teare	Consultant Medical Microbiologist, Public Health Laboratory, Chelmsford, 9.9.85
Dr RE Tettmar	Director, Public Health Laboratory, Chelmsford, 2.9.85
Dr PD Thomas	Consultant Medical Microbiologist, Public Health Laboratory, Swansea, 14.10.85
Dr ER Youngs	Consultant Medical Microbiologist, Public Health Laboratory, Lincoln, 1.5.85
Dr PM Zadik	Consultant Medical Microbiologist, Public Health Laboratory, Sheffield, 2.9.85

Retirements

Dr DR Gamble	Director, Public Health Laboratory, Epsom, 15.8.85
Mr R Holmes	Deputy Director, PHLS Centre for Applied Microbiology and Research, 31.5.86
Dr W Kwantes	Director, Public Health Laboratory, Swansea, 30.9.85
Dr PD Meers	Deputy Director of the Service, Public Health Laboratory Service Board, 31.3.86
Dr PM Poole	Consultant Medical Microbiologist, Public Health Laboratory, Chester, 4.8.85
Dr JEM Whitehead	Director of the Service, 24.9.85

Honours, awards and external offices

Dr DFJ Brown	Secretary of the Antimicrobial Susceptibility Testing Subcommittee of the European Committee for Clinical Laboratory Standards
Dr RY Cartwright	Chairman, Department of the Environment Subcommittee on the Microbiological Examination of Sea, Estuary and Fresh Recreational Waters
Dr EO Caul	WHO Consultant—Workshop on Electron Microscopy, Hong Kong
Dr JG Cruickshank	Joint Editor, *Journal of Hygiene*
Mrs ST Denyer	Winner (1985), JD Atkinson Memorial Prize
Dr ID Farrell	Royal College of Pathologists Standing Advisory Committee on Microbiology
Dr IR Ferguson	Territorial Decoration
Dr PA Jenkins	Treasurer, Cardiff Chest Federation
Dr C Roberts	Member, Council of the Association of Clinical Pathologists
Dr WA Telfer Brunton	Vice-Chairman/Chairman Elect of the Cornwall and Isles of Scilly Medical Executive Committee
Mr MD Yates	Member, European Society of Mycobacteriologists Member, International Working Group on Mycobacterial Taxonomy

Senior PHLS staff

Headquarters Office

61 Colindale Avenue, London, NW9 5DF
Telephone 01-200 1295

Dr JWG Smith	Director of the Service (from 12.9.85)
Dr JEM Whitehead	Director of the Service (until 11.9.85)
Dr Joan R Davies	Deputy Director of the Service
Mr EA Meyrick	Assistant to the Director of the Service (from 1.2.86)
Mr RB Paget	Secretary to the Board
Mr JM Harker	Deputy Secretary to the Board
Mr KM Saunders	Treasurer to the Board
Mrs Susan D Chaney	Deputy Treasurer to the Board
Mr DS Broadfield	Personnel Officer
Mrs Christine R Shipp	Manager, PHLS Computer Services
Mr JB Towell	Supplies Officer

Central Public Health Laboratory

61 Colindale Avenue, London, NW9 5HT
Telephone 01-200 4400

Professor AA Glynn	Director
Mr MR Turner	Administrator
Mr S Daniels	Deputy Administrator
Mrs Susan A Bloomfield	Chief Librarian
Dr B Rowe	Director, Division of Enteric Pathogens
Professor E Mary Cooke	Director, Division of Hospital Infection
Dr AG Taylor	Director, Division of Microbiological Reagents and Quality Control
Dr Sheila Polakoff	Director, Hepatitis Epidemiology Unit

Dr RJ Gilbert	Director, Food Hygiene Laboratory and Deputy Director, Central Public Health Laboratory
Professor DWR Mackenzie	Director, Mycological Reference Laboratory
Dr LR Hill	Curator, National Collection of Type Cultures
Dr MS Pereira	Director, Virus Reference Laboratory

PHLS Communicable Disease Surveillance Centre

61 Colindale Avenue, London, NW9 5EQ
Telephone 01-200 6868

Dr NS Galbraith	Director
Dr Susan EJ Young	Deputy Director
Mr AA Collins	Administrator

PHLS Centre for Applied Microbiology and Research

Porton Down, Salisbury, Wiltshire, SP4 0JG
Telephone 0980 610391

Dr PM Sutton	Director
Mr IR Ingrey-Counter	Administrator
Mr D Kitching	Deputy Administrator
Dr MJ Hill	Director, Bacterial Metabolism Research Laboratory
Dr A Baskerville	Director, Experimental Pathology Laboratory
Professor A Atkinson	Director, Microbial Technology Laboratory
Dr PJ Greenaway	Director, Molecular Genetics Laboratory
Dr O Basarab	Director, Quality Control and Safety Laboratory
Dr ETW Bowen	Acting Director, Special Pathogens Reference Laboratory
Professor J Melling	Director, Vaccine Research and Production Laboratory

Other Reference Laboratories and Units

Dr AT Willis	Director, PHLS Anaerobe Reference Unit, PHLS Laboratory, Luton
Dr AE Jephcott	Director, PHLS Gonococcus Reference Unit, PHLS Laboratory, Bristol
Dr Joan R Davies	Director, PHLS Influenza Research Unit, PHLS Laboratory, Guildford
Dr Sheena M Waitkins	Director, PHLS Leptospira Reference Unit, PHLS Laboratory, Hereford
Professor DJ Bradley	Co-Director, PHLS Malaria Reference Laboratory, London School of Hygiene and Tropical Medicine
Professor W Peters	Co-Director, PHLS Malaria Reference Laboratory, London School of Hygiene and Tropical Medicine
Dr PA Jenkins	Director, PHLS Mycobacterium Reference Unit, PHLS Laboratory, Cardiff

PHLS regional laboratory Directors

Addresses and telephone numbers of PHLS regional laboratories are listed in telephone directories

Dr JGP Hutchison	Birmingham
Dr AE Jephcott	Bristol
Dr CED Taylor	Cambridge
Dr CHL Howells	Cardiff
Dr RN Peel	Leeds
Dr GC Turner	Liverpool
Dr DM Jones	Manchester
Dr AE Wright	Newcastle upon Tyne
Dr JB Selkon	Oxford
Dr OA Okubadejo	Portsmouth
Dr BW Barton	Sheffield

PHLS area laboratory Directors

Addresses and telephone numbers of PHLS area laboratories are listed in telephone directories

Dr C Dulake	Ashford
Dr Diana G White	Bath
Dr BT Thom	Brighton
Dr Margaret A Knowles	Carlisle
Dr HDS Morgan	Carmarthen
Dr RE Tettmar	Chelmsford
Dr JH Pennington	Chester
Dr PR Mortimer	Coventry
Dr Patricia Gill	Dorchester
Dr EI Tanner	Epson
Dr RJC Hart	Exeter
Dr KAV Cartwright	Gloucester
Professor RY Cartwright	Guildford
Dr IR Ferguson	Hereford
Dr SL Mawer	Hull
Dr PH Jones	Ipswich
Dr CJ Mitchell	Leicester
Dr JG Wallace	Lincoln
Dr DA McSwiggan	Central Middlesex Hospital, London
Dr Anne HC Uttley	Dulwich, London
Dr DG Fleck	Tooting, London
Dr B Chattopadhyay	Whipps Cross, London
Dr AT Willis	Luton
Dr E McKay-Ferguson	Middlesbrough
Dr W Shepherd	Norwich
Dr MJ Lewis	Nottingham
Dr RS Jobanputra	Peterborough
Dr PJ Wilkinson	Plymouth

Dr WL Hooper	Poole
Dr DN Hutchinson	Preston
Dr JV Dadswell	Reading
Dr DN Looker	Rhyl
Dr Sharon Patrick	Salisbury
Dr CA Morris	Shrewsbury
Dr AD Pearson	Southampton
Dr J Gray	Stoke-on-Trent
Dr DHM Joynson	Swansea
Dr NF Lightfood	Taunton
Dr WA Telfer Brunton	Truro
Dr MT Moulsdale	Watford
Dr RG Thompson	Wolverhampton

Principal committees

Chairmen and Secretaries at 3 December 1986

Committees appointed by the Board

Finance and General Purposes Committee	Chairman Dr CE Gordon Smith Secretary Mr KM Saunders
Ethical Committee	Chairman Professor R Hurley Secretary Professor AA Glynn
Board Accountability Working Group	Chairman Dr M Sackwood

Other PHLS committees, subcommittees and working parties

Steering Committee on National External Quality Assessment in Microbiology	Chairman Dr Joan R Davies Secretary Dr ID Farrell
AIDS Action Co-ordinating Committee	Chairman Professor AA Glynn Secretary Dr AD Pearson
Research Project Committee	Chairman Dr AT Willis Secretary Dr SR Palmer
Standing Advisory Committee on Electron Microscopy	Chairman Dr TH Flewett Secretary Dr AM Field
Standing Advisory Committee on Influenza	Chairman Dr RJC Hart Secretary Dr CA Morris
Standing Advisory Committee on Laboratory Safety	Chairman Dr AE Wright Secretary Dr WA Telfer Brunton
Publications Editorial Committee	Chairman Dr RJC Hart Secretary Brian Guthrie
Publications Management Committee	Chairman Mr JM Harker Secretary Mr JB Towell
Standing Advisory Committee on Serological Reagents	Chairman Dr Joan R Davies Secretary Dr AG Taylor
Standing Advisory Committee on Sexually Transmitted Diseases	Chairman Dr GC Turner Secretary Dr AE Jephcott
Committee on Hepatitis	Chairman Dr J Craske Secretary Dr Sheila Polakoff

Library Policy Committee	Chairman Professor AA Glynn Secretary Mrs S Bloomfield
Committee on Salmonellas	Chairman Dr JG Cruickshank Secretary Dr SL Mawer
Standing Committee on the Microbiology of Water	Chairman Dr JV Dadswell Secretary Dr MJ Lewis
Committee on Legionnaires' Disease	Chairman Dr AE Wright Secretary Dr CLR Bartlett
Working Party on Viral Gastroenteritis	Chairman Dr DA McSwiggan Secretary Dr H Appleton
Working Group on Campylobacter Infections	Chairman Dr MB Skirrow
Working Group on Performance Indicators	Chairman Dr Joan R Davies
Zoonoses Consultative Panel	PHLS representatives are Director of the Services (or Deputy), Professor RY Cartwright, Dr RJC Hart, Dr SR Palmer, Dr B Rowe
Working Party on the Epidemiological & Virological Aspects of Fifth Diseases	Chairman Dr PP Mortimer Secretary Dr SM Hall
Computer Services Steering Group	Chairman Dr AT Willis

Scientific publications

This account of PHLS contributions to the scientific literature is listed in the categories **Antimicrobials**, **Cancer research**, **Disinfection**, **Epidemiology**, **Food microbiology**, **Immunology**, **Laboratory safety**, **Specific bacteria and infections**, **Viruses and viral infections**, **Other organisms and infections**, **Techniques**, **Others**, **Books**, **PHLS reports**, **Reports of committees**.

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Accounts of the PHLS Board 1985/86

These pages provide a summary of the accounts of the PHLS Board for 1985/86. The notes also form part of the accounts.

Receipts and payments for the year ending 31 March 1986

	Notes	1985/86 £	1984/85 £
HMG grants received	2	29,074,575	26,182,344
Operating receipts	3	6,787,527	6,207,433
		35,862,102	32,389,777
Salaries and wages	4	23,687,771	21,776,171
Other operating payments	5	12,176,990	10,527,803
		35,864,761	32,303,974
Other receipts/payments (net)	6	52,579	(102,517)
Excess of receipts over payments/(payments over receipts) for the financial year		49,920	(16,714)
Statement of balances at 31 March 1986			
Balance at beginning of financial year		205,449	222,163
Excess of receipts over payments/(payments over receipts) for the financial year		49,920	(16,714)
Balance at end of financial year	7	255,369	205,449

Notes to the accounts

1 These accounts are drawn up in a form determined by the Secretary of State, and approved by the Treasury.

2 HMG grants received

	1985/86	1984/85
	£	£
Grant received from Class XI, vote 3, 1985/86 (England)	27,543,575	24,647,344
Grant received from Class XVI, vote 1, 1985/86 (Wales)	1,531,000	1,535,000
	29,074,575	26,182,344

3 Operating receipts

The Board charges for services provided and sells microbial and other products to various government, commercial and other bodies. In addition, grants are received for the purpose of research and development.

Grants (excluding capital receipts)	1,476,724	1,481,964
Receipts from sales	1,724,370	1,372,400
Rechargeable services and facilities	3,467,592	3,251,095
Other receipts	118,841	101,974
	6,787,527	6,207,433

4 Salaries and wages

(a) Board members' remunerations—fees	6,410	2,678

(b) Senior employees

The following senior employees received remuneration falling within these ranges.

£	Number	Number
30,000–35,000	28	25
35,001–40,000	13	14
40,001–45,000	—	3
45,001–50,000	7	1

5 Other operating payments	£	£
Premises	886,379	611,262
Fuel, light, heating and cleaning	1,178,753	962,924
Laboratory consumables/equipment maintenance	5,362,857	4,506,938
Equipment (excluding capital)/ minor works and alteration.	2,422,149	1,717,591
Administration and transport	1,983,712	1,974,812
Cost sharing payments to health authorities/audit fee	343,140	754,276
	12,176,990	10,527,803

6 Other receipts/(payments) (net)	£	£
Grant (Capital) received from class XI, vote 3, 1985/6 England	3,555,000	11,457,000
Grant (Capital) received from class XVI, vote 1, 1985/6 Wales	172,000	—
Capital receipts—Grants	140,683	282,256
—Other	45,000	98,000
	3,912,683	11,837,256
Works, buildings and associated equipment	3,860,104	11,939,773
	52,579	(102,517)

7 Balance at year end		
Net balance held on behalf of/ (owing to) third parties	106,240	(290,631)
Cash at bank	142,567	489,201
Cash held at laboratories	6,562	6,879
	255,369	205,449

8 Special funds
The Board held balances of £2,178 at 31 March 1986 (£2,067 at 31 March 1985)

9 Statement of losses

Fruitless payment: production centre remedial works. The costs of the remedial works are still being negotiated but are estimated to be in the region of £1 million (of which £121,273 was expended in 1985/86), and action is being taken to recover such sums from the contractors who were at fault.

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Accounts of the PHLS Board 1985/86

These pages provide a summary of the accounts of the PHLS Board for 1985/86. The notes also form part of the accounts.

Receipts and payments for the year ending 31 March 1986

	Notes	1985/86 £	1984/85 £
HMG grants received	2	29,074,575	26,182,344
Operating receipts	3	6,787,527	6,207,433
		35,862,102	32,389,777
Salaries and wages	4	23,687,771	21,776,171
Other operating payments	5	12,176,990	10,527,803
		35,864,761	32,303,974
Other receipts/payments (net)	6	52,579	(102,517)
Excess of receipts over payments/(payments over receipts) for the financial year		49,920	(16,714)
Statement of balances at 31 March 1986			
Balance at beginning of financial year		205,449	222,163
Excess of receipts over payments/(payments over receipts) for the financial year		49,920	(16,714)
Balance at end of financial year	7	255,369	205,449

Notes to the accounts

1 These accounts are drawn up in a form determined by the Secretary of State, and approved by the Treasury.

2 HMG grants received

	1985/86 £	1984/85 £
Grant received from Class XI, vote 3, 1985/86 (England)	27,543,575	24,647,344
Grant received from Class XVI, vote 1, 1985/86 (Wales)	1,531,000	1,535,000
	29,074,575	26,182,344

3 Operating receipts

The Board charges for services provided and sells microbial and other products to various government, commercial and other bodies. In addition, grants are received for the purpose of research and development.

Grants (excluding capital receipts)	1,476,724	1,481,964
Receipts from sales	1,724,370	1,372,400
Rechargeable services and facilities	3,467,592	3,251,095
Other receipts	118,841	101,974
	6,787,527	6,207,433

4 Salaries and wages

(a) Board members' remunerations—fees	6,410	2,678

(b) Senior employees

The following senior employees received remuneration falling within these ranges.

£	Number	Number
30,000–35,000	28	25
35,001–40,000	13	14
40,001–45,000	—	3
45,001–50,000	7	1

5 Other operating payments	£	£
Premises	886,379	611,262
Fuel, light, heating and cleaning	1,178,753	962,924
Laboratory consumables/equipment maintenance	5,362,857	4,506,938
Equipment (excluding capital)/ minor works and alteration.	2,422,149	1,717,591
Administration and transport	1,983,712	1,974,812
Cost sharing payments to health authorities/audit fee	343,140	754,276
	12,176,990	10,527,803

6 Other receipts/(payments) (net)	£	£
Grant (Capital) received from class XI, vote 3, 1985/6 England	3,555,000	11,457,000
Grant (Capital) received from class XVI, vote 1, 1985/6 Wales	172,000	—
Capital receipts—Grants	140,683	282,256
—Other	45,000	98,000
	3,912,683	11,837,256
Works, buildings and associated equipment	3,860,104	11,939,773
	52,579	(102,517)

7 Balance at year end		
Net balance held on behalf of/ (owing to) third parties	106,240	(290,631)
Cash at bank	142,567	489,201
Cash held at laboratories	6,562	6,879
	255,369	205,449

8 Special funds
The Board held balances of £2,178 at 31 March 1986 (£2,067 at 31 March 1985)

9 Statement of losses

Fruitless payment: production centre remedial works. The costs of the remedial works are still being negotiated but are estimated to be in the region of £1 million (of which £121,273 was expended in 1985/86), and action is being taken to recover such sums from the contractors who were at fault.

The Central Public Health Laboratory
Opened by Her Majesty the Queen
11 December 1985